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E.M.B.

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OF THE

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OF

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SESSION 1889-90.

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1886. Lingard, A., Poonah, India.
C. 1851. Litt, W., Veterinary Surgeon, Shrewsbury, Salop.
N.R. 1873. Little, James, M.D., 14, Stephen's Green North, Dublin.
N.R. 1885. Lloyd, W. Harris, M.D., Dep. Inspec.-Gen. (*gone abroad*).
C. 1857. Lowtzoff, —, St. Petersburg, Russia.
N.R. 1881. Lyons, R. T., M.D., Surgeon-Major, Rampart Barracks, Fort William, Calcutta.
C. 1887. McLaurin, H. A., M.D., Sydney, New South Wales.
C. 1870. Mallet, —, M.D., Warsaw.
N.R. 1867. Marshall, John, 13, Liverpool Street, Dover.
N.R. 1860. May, George, jun., 43, Castle Street, Reading, Berks.
N.R. 1889. McVail, John C., M.D., Kilmarnock, Ayrshire.
C. 1886. Moleschott, Jacob, M.D., Rome.
N.R. 1872. Moore, John Wm., M.D., 40, Fitzwilliam Square West, Dublin.
C. 1851. Monzon, Rafael, Barbacaos, New Grenada.
C. 1853. Neumann, —, M.D., Berlin.
C. 1851. Noble, Daniel, M.D., 258, Oxford Road, Manchester.
N.R. 1881. Oldham, Chas., Brigade Surg. Ind. Med. Dept., Shurdington Road, Cheltenham.
C. 1872. Poggio, Don Ramon Hernandez, Cuba.
C. 1854. Purple, S. S., M.D., New York, U.S.A.
N.R. 1879. Ransom, W. H., M.D., F.R.S., Nottingham.
N.R. 1875. Ransome, Arthur, M.D., F.R.S., Devisdale, Bowdon, Cheshire.
N.R. 1884. Ray, George, Surg.-Gen., 76, Jermyn Street, S.W.
N.R. 1880. Reid, Sir J. Watt, K.C.B., M.D., R.N.
N.R. 1874. Reid, Walter, M.D., Fleet-Surgeon, Royal Naval Hospital, Haslar.
N.R. 1866. Robertson, James, M.D., Alfred Place, Melbourne.
C. 1886. Rochard, G., M.D., Paris.
N.R. 1863. Rowe, T. Smith, M.D., Cecil Street, Margate.
N.R. 1879. Ross, J. T. C., C.I.E., Surgeon-General Ind. Med. Dept., The Grove, Ryde, Isle of Wight.
N.R. 1881. Russell, E. G., M.B., B.Sc., Surg. Ind. Med. Dept., Gauhàti, Assam, India.
N.R. 1875. Russell, J. B., M.D., 1, Montrose Street, Glasgow.

Elected.
N.R. 1859. Sanderson, J. Burdon, M.D., F.R.S., 64, Banbury Road, Oxford.
C. 1851. Sankey, F. F., Malta.
C. 1879. Sarell, Richard, M.D., Pera and Therapia, Constantinople.
C. 1873. Schleisner, —, M.D., Copenhagen.
C. 1874. Schlimmel, —, M.D., Teheran.
C. 1852. Schürmayer, Professor, Heidelberg, Germany.
N.R. 1858. Scratchly, G., New Orleans, U.S.A.
C. 1851. Sharpe, Richard, Beverley Road, Hull.
C. 1853. Sigmund, C. L., Vienna.
N.R. 1884. Simpson, W. J., M.D., Bengal Club, Calcutta.
N.R. 1888. Smith, F., Montreal, Cargate Avenue, Aldershot.
1890. Smith, P. C., Motherwell, Lanarkshire.
N.R. 1867. Smith, R. Wagstaff, Mount Rundell, Harborne, Birmingham.
C. 1886. Sonsino, Prospero, 11, Via San Lorenzo, Pisa.
N.R. 1854. Spinks, C. N., Sankey Street, Warrington.
C. 1851. Spooner, W. C., Vet. Surg., Southampton.
C. 1876. Sternberg, Geo. M., M.D., United States Army, Port Point, San Jose, San Francisco, California.
N.R. 1885. Sturridge, P. F., Kendal, Westmorland.
N.R. 1880. Tatham, John, M.D., Town Hall, Salford, Manchester.
C. 1860. Taylor, H. Sharp, 15, Quarry Street, Guildford.
C. 1855. Tholozan, J. Désiré, M.D., Teheran.
C. 1888. Thompson, Ashburton, M.D., Sydney, New South Wales.
N.R. 1853. Todd, J. George, Evenwood, West Auckland, Durham.
N.R. 1885. Tomes, Arthur, Surg. Ind. Med. Service, Bengal.
N.R. 1873. Townsend, Stephen Chapman, C.B., Surg.-Gen. Ind. Med. Dept., Sanitary Commissioner for Central India.
C. 1851. Tribes, E., Nismes, France.
C. 1855. Tribuchet, Adolphe, Paris.
C. 1853. Valerj, —, M.D., Rome.
C. 1855. Virchow, Rudolf, Professor, 10, Schellings Strasse, Berlin.
C. 1856. Von Iffland, —, Beaufort, New Quebec.
N.R. 1879. Watson, Alexander, M.D., R.N., Dep. Insp.-Gen., Army and Navy Club.
C. 1853. Watson, John, M.D., Jamaica.
N.R. 1887. Welch, Henry, M.D., Blackpool, Lancashire.
N.R. 1880. Whishaw, J. C., M.D., Surg.-Major Ind. Med. Dept., Lucknow.
N.R. 1880. White, J. Berry, M.D., Surg.-Major Ind. Med. Dept. (*address not known*).
C. 1861. Whitelaw, Wm., M.D., Kirkintilloch, Dumbartonshire.
N.R. 1854. Wiblin, John, Southampton.
N.R. 1865. Williams, C., 48, Prince of Wales's Road, Norwich.
N.R. 1884. Williamson, R. E., M.B., Brookfield, Lymm, Cheshire.
N.R. 1875. Wortabet, John, M.D., St. John's Hospital, Beyrout.

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TRANSACTIONS
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Epidemiological Society of London.

INAUGURAL ADDRESS OF SESSION 1889-90.

By SIR THOMAS CRAWFORD, K.C.B., M.D., LL.D.

(*Read: November 13th*, 1889.)

GENTLEMEN,—My first duty on taking this chair is to thank you for the honour you have conferred upon me by electing me as your President. During the quarter of a century covered by my membership, the Society has done some excellent work in educating public opinion on many most important points bearing on the health and happiness of the people, as well as upon the commercial prosperity of the nation, still too much hampered by so-called sanitary restrictions upon international intercourse. Originating in a superstitious dread of "the pestilence that walketh in darkness", and maintaining their hold upon the public through ignorance of the conditions under which epidemic diseases arise, the laws which govern their spread, and the best methods of prevention, they are not easily eradicated.

In looking over the earlier volumes of our *Transactions*, I find the objects of the Society thus stated:—"To institute a rigid examination into the causes and conditions which influence the origin, propagation, mitigation, prevention, and treatment of epidemic diseases; to collect and promulgate, with relation to these subjects, such facts as appear to be established on sound and sufficient evidence, and to point out those methods of investigation by which the misleading influence of false or deficient evidence may be best avoided. Such inquiries should include all that relates to overcrowding, to errors of construction affecting light and ventilation of buildings, to deficient supply of water, to imperfect cleansing and drainage, and to insufficiency of food and clothing. To investigate the diseases prevailing extensively among domestic and other animals, as well as those that affect the vegetable kingdom."

This field has been fairly covered by the labours of the members, in so far as some of the more striking forms of epidemic disease are concerned; but the sphere of useful observation and research has been by no means exhausted, although the self-imposed task of the Epidemiological Society has been, of late years, largely shared by other societies having the advancement of sanitary science specially in view.

The volumes of our *Transactions*, and the admirable reports published from time to time by the Medical Officers of the Local Government Board, most of whom have been in the past, and are in the present, members of our Society, have made the public familiar with the history of the great epidemics which have visited this and other countries during the century now drawing to a close. The medical officers of the public services have taken a prominent part in similar investigations, and as their labours have been carefully recorded, in regard to the army at least, it may not be amiss to lay before you some of the results, in so far as these bear upon epidemiology, and upon the stamping out of the diseases held to be altogether preventable. These results are in the main satisfactory, although much still remains to be done, and must, it is to be feared, so remain till the people realise the fact that on their own and on their neighbours' shoulders must rest the responsibility for injury to health, the pecuniary loss which sickness entails, especially on the working-classes, and the sacrifice of useful lives daily occurring in our great centres of population, and in a less degree throughout the country at large. This responsibility men are prone to lay upon Providence rather than upon their own possibly ignorant violations of laws which Providence has ordained for their guidance, and which sanitary science is daily endeavouring to make clear to them, although with less satisfactory results than many regard as practicable, and all admit to be desirable.

It may be well, perhaps, to remark here that there are many terms in common use in regard to epidemic diseases which require definition. Prominent among these may be mentioned epidemic prevalence, epidemic constitution, epidemic influence, epidemic wave, epidemic laws, etc. These terms spring out of our want of clear knowledge regarding the nature of the diseases in question, and will, no doubt, receive some modification, or possibly disappear altogether, under the clearer views of etiology and pathology dawning upon us through bacteriological and chemical discoveries, which modern research is daily bringing to light. Under the first of these terms it is not uncommon to find diseases men-

tioned for no other reason, apparently, than that they have been of unusually frequent occurrence among a given community, although they may not be dependent upon any cause capable of producing a true epidemic. Again, when any zymotic disease has become prevalent, we are apt to assume the existence of an epidemic constitution or influence favouring the development and spread of the disease, or of undue susceptibility on the part of those affected, while, in reality, the cause is a physical and demonstrable one, lying within easy reach, and admitting of prompt removal.

In the army we have a more accurate record of the sickness and mortality from zymotic diseases than it is possible to obtain regarding the great mass of the people. I select from this source Sub-group I of General Diseases for remark, because, in the words of Sir William Jenner when writing of zymotic diseases generally, "the diseases constituting it, dissimilar as they are in their pathology, are so intimately connected in their etiology that the removal of the causes of one of the group would certainly and greatly diminish the mortality from all." This is especially true of those causes which contribute to the epidemic prevalence of these diseases.

The average strength of the army for 1887, excluding local corps recruited from natives of our Colonial and Indian settlements, was 195,932, scattered over the various military stations in the United Kingdom, Channel Islands, Gibraltar, Malta, Cyprus, Egypt, Canada, Bermuda, West Indies, South Africa, Mauritius, Ceylon, China, Straits Settlements, India, and on board ships in transit from one part of the Queen's dominions to another. This distribution of Her Majesty's troops covers vast tracts of the world's surface over which great epidemics have often prevailed, and will, it may be feared, again do so. Moreover, they garrison many points along the great routes of human intercourse by which epidemic diseases are usually held to be propagated. At all events, they are as fully and freely exposed to every pandemic and epidemic influence as others, and if equally susceptible and unguarded, would no doubt suffer equally with them.

Following the nomenclature of diseases recently issued by the Royal College of Physicians of London, and approved for use in Her Majesty's public services, and taking Sub-group I of general diseases, which includes: 1, small-pox; 2, cow-pox; 3, chicken-pox; 4, measles; 5, epidemic rose rash; 6, scarlet fever; 7, dengue; 8, typhus fever; 9, plague; 10, relapsing fever; 11, influenza; 12, whooping-cough; 13, mumps; 14, diphtheria; 15, cerebro-spinal fever;

16, simple continued fever; 17, enteric fever; 18, yellow fever; 19, cholera; 20, sporadic cholera; 21, epidemic diarrhœa; 22, dysentery; the army tables give the following results.

In order to avoid verbal repetitions, the ratios of admissions, deaths, and constantly sick are in all cases calculated on 1,000 of strength.

England—Strength, 72,329; ratio of admissions, 17.2; of deaths, 0.40; constantly sick, 0.99. *Scotland*—Strength, 3,635; ratio of admissions, 13.2; of deaths, 0.27; constantly sick, 0.57. *Ireland*—Strength, 25,150; ratio of admissions, 20.2; of deaths, 0.48; constantly sick, 1.09. Of the admissions under this head in the United Kingdom 137 were from enteric fever, of whom twenty-eight died, being just two-thirds of the deaths from all diseases included in the sub-group. Sixty-one, with sixteen deaths, occurred in England and Wales; three, with one death, in Scotland; and seventy-three, with nine deaths, in Ireland. All the military districts in England were affected to some extent, with the exception of Chatham, which had also had an immunity from this disease for the previous three years. London yielded ten cases, with two deaths. Three of the cases are said to have been imported from Dublin; one is ascribed to defective drainage, and one occurred in the person of a recruit just joined; for the others no cause has been assigned. Aldershot contributes six cases, some of which were supposed to be due to a defective condition of the subventilation of the huts. Shoeburyness returns five cases, of which four proved fatal. These are ascribed to a sewer from the village opening on the foreshore near the huts. At Parkhurst there were four cases and two deaths, probably due to water-impurity. There were also four cases and one death at Portsmouth, due to defective drainage. Hounslow contributes three cases, said to have been imported; Manchester three, Dover three, of which two are attributed to defective drainage, but for the third no cause could be traced. There were two cases at Great Yarmouth, two at Pembroke Dock, all probably due to impure water; two at Guernsey, said to have been contracted in the town; two at Woolwich, believed to have originated elsewhere; one at Cardiff, and one at Alderney, ascribed to impure water; one each at Guildford, Leeds, Liverpool, Newcastle-on-Tyne, York, Harwich, Winchester, Netley, Sandown, and Devonport, for which no cause could be discovered.

Of the three cases in Scotland two occurred in Glasgow and one at Piershill, near Edinburgh, no cause being mentioned.

The number of stations in Ireland at which cases of enteric fever occurred was thirty-nine. Fifty cases, with four deaths, are reported from Dublin, namely, twenty-three from the Royal barracks, nine from Pigeon-House fort, a small barracks on the end of the pier at the mouth of the harbour; five from Ship Street barracks, located in a densely populated district close to the Castle; four from Arbour Hill hospital, all Hospital Corps men, of whom two had been attendants on cases of this disease. Beggars' Bush barracks contributed three cases; Richmond barracks, two; Linen Hall barracks, one. One case was admitted from lodgings, one from furlough, and one from another station. The history of enteric fever among the troops in Dublin is most perplexing. There is much in the structural and sanitary arrangements of the barracks to which exception may be taken, and for the removal of which remedial measures have been suggested, and are now in the course of being carried out; but whether the results will be altogether satisfactory is open to doubt. Sound sanitary principles must be vigorously applied to the city as a whole before satisfactory progress in stamping out this disease can be hoped for. An improved system of drainage, which will free the Liffey, and secure an uninterrupted flow of all sewage to a safe distance, is a first and most pressing need, without which other measures can only be regarded as palliatives.

Belfast contributes six cases, four of which were admitted from Hollywood Camp, and were reasonably attributed to a contaminated water-supply. Five cases are reported from the Curragh; Enniskillen and Kilkenny contribute two each, no cause being given; while a like number occurred at Dundalk, one of which is said to have come from Dublin. Two cases at Limerick, said to have been contracted outside the barracks, and one case each at Tipperary, Galway, Haulbowlin, and Fermoy, account for the whole of the admissions in Ireland.

There were 745 admissions under the head of eruptive fevers, including seven with one death from small-pox, and 185 with eight deaths from scarlet-fever; measles, rose rash, chicken-pox, and cow-pox account for the remainder. There were also 689 cases of continued fever, ninety-six cases of dysentery with one death, and 134 cases of other diseases with one death, included in the sub-group under review; but none of these diseases, except scarlet-fever, could be said to have assumed an epidemic form in any of the home stations during the year.

Before attempting to draw any inferences from these facts

it may be well to trace the history of this group of diseases through the other commands of the Empire, and this I shall do as briefly as possible, dealing with the various garrisons in the order in which I have already enumerated them; and first of—

Gibraltar.—Average strength, 4,614; ratio of admissions, 31.4; of deaths, 1.95; constantly sick, 4.28; the whole of the admissions are grouped under three classes of diseases, viz., eruptive fevers, five cases, no deaths; enteric fever, thirty-five cases, nine deaths; other continued fevers, 105 cases, no deaths. The columns for other diseases of this sub-group are blank. The medical officer in charge reports that the cases of enteric fever were all severe; convalescence was very protracted, and relapses were frequent. With regard to the cases of continued fever which occurred during the same period, he was of opinion that "it is not a climatic fever, but depends upon local sanitary defects, and is more prevalent in hot and dry months, because the water-traps of drains then often become dry, and are no longer effective. In almost every instance where severe cases of fever have occurred in barracks, blocked drains, defective traps, rat-holes communicating with sewers, or unknown and disused drains, have been discovered under floors, and when these defects have been remedied no further cases have occurred." The same officer goes on to remark: "There is a close connection between simple continued fever and enteric fever; they are both admitted from the same barrack at the same time, and when a sanitary defect is discovered and removed both fevers cease to occur." Buena Vista barracks, which suffered severely from fever in 1886, were comparatively free from it in 1887, while Europa barracks, which in the former year gave no cases, in the latter gave several. On turning to the report for 1886 I find, under the head of enteric fever, the following:—"The disease prevailed in an epidemic form in June, July, and August, in the Royal West Kent Regiment, the Royal Engineers, and the South Staffordshire Regiment. Those troops occupied barracks far apart from one another, and no connection was traced between the outbreaks in each barracks. The rest of the garrison was remarkably free from fever during these three months. The Royal West Kent Regiment arrived from Egypt on the 16th June, and was quartered in the Casemate barracks. Cases of enteric fever were admitted daily from all companies of this regiment up to the middle of July, when the outbreak ceased. The disease in this corps was evidently contracted in Egypt; and it is believed that very few, if any, cases

originated in the garrison. The outbreak of the disease among the troops quartered in the Town range, Hargraves, and Buena Vista barracks was, in the opinion of the medical officer in charge, sufficiently accounted for by certain serious sanitary defects which existed in them, which is borne out by the fact that the disease ceased when the barracks were vacated, and when they were reoccupied after the defects had been remedied there was no recurrence of the disease." The theory of importation from Egypt, in the case of the South Staffordshire Regiment, seems to require some qualification, for a little further on Dr. Warren adds: "With regard to the cases which occurred at Buena Vista, it is stated that nearly all came from a stone two-storied building, occupied by two-and-a-half companies of the South Staffordshire Regiment, and that three companies of the same regiment, which arrived from Ramleh at the same time, and were quartered at Windmill Hill, did not furnish a single case of the fever." If the disease was of Egyptian origin the whole regiment would presumably have suffered, and the cases would have occurred soon after the arrival of the corps, as was the case in the Royal West Kent Regiment.

Malta.—Strength, 5,499; ratio of admissions, 110.7; of deaths, 2.72; constantly sick, 10.66. The diseases yielding these results were small-pox, two; measles, one; enteric fever, fourteen, with five deaths; other continued fevers, 570, with seven deaths; cholera, one case, fatal; dysentery, nineteen, with two deaths; other diseases, two. The fevers alone account for nearly the whole of the sickness and mortality under this head; and were the admitted difficulties of diagnosis fully met, and the classification of cases thus rendered perfectly accurate, we might possibly be able to add that enteric fever alone is accountable for nearly the whole of the mortality.

Of the origin of this disease the medical officer in charge at Cottonera remarks: "The cause remains obscure; but most probably the insanitary conditions of the wine-shops and other houses frequented by the men were in fault." It is difficult to reconcile this theory with the fact recorded in the report, that the Malta Fencibles, who are natives of the island, and presumably in closer social intercourse with the inhabitants, were entirely free from the disease.

In commenting upon these cases, Surgeon-General Sinclair remarks: "There were no cases of this disease on the Valetta side, which speaks volumes for the water-supply, this being the only district where aqueduct-water was in general use throughout the year." It is interesting to note here that,

though there was an epidemic of cholera prevailing among the civil community in the months of August, September, and October, the history of which has been already laid before the Society, there was but one case among the British troops and one among the Malta Fencibles.

Cyprus.—Strength, 472; ratio of admissions, 70.0; of deaths, 2.12; of constantly sick, 4.70. There were three cases of enteric fever, with one death. The remaining cases were twenty of simple continued fever and eleven of dysentery, all mild.

Canada.—Strength, 1,282; ratio of admissions, 4.7; of deaths, 0.0; constantly sick, 0.29. The admissions were five cases of measles and one of enteric fever.

Bermuda.—Strength, 1,183; ratio of admissions, 86.2; of deaths, 6.76; of constantly sick, 8.07. The whole of the admissions, with the exception of one case of dysentery, range themselves under enteric fever and common continued fever in equal proportions, all the deaths having been caused by the former. This outbreak was, with reasonable probability, attributed to impure water.

West Indies, includes Barbadoes, Jamaica, Trinidad, Demerara, Honduras, Bahamas. Strength, 1,121; ratio of admission, 161.5; of deaths, 6.25; of constantly sick, 5.72. Fourteen of the admissions and the whole of the deaths were from enteric fever. Eleven occurred in Jamaica, one at Up-park Camp, which proved fatal, and ten, with five deaths, at Newcastle. Frequenting rum-shops, and contaminated water, are stated to have been the probable causes of the outbreak at Newcastle. The black troops in the West Indies have not suffered from enteric fever, although by no means exempt from other forms of continued fevers. The other diseases of this sub-group occurring among the troops in these islands do not call for special notice, no deaths having occurred from any of them.

Cape and St. Helena.—Strength, 3,490; ratio of admissions, 21.5; of deaths, 0.86; of constantly sick, 1.73. There were five cases of enteric fever, two admissions, with one death, at Cape Town, and three admissions, with one death, at Pietermaritzburg. There were also forty-four cases of continued fever of a mild type, and twenty-three cases of dysentery, with one death, but neither of these diseases can be said to have assumed an epidemic form.

Mauritius.—Strength, 400; ratio of admissions, 82.5; of deaths, 10.0; of constantly sick, 5.37. There were thirty-three admissions and four deaths in all, one from enteric

fever, seven from other continued fevers, with three deaths, and twenty-five from dysentery, with one death. The fevers are described as typho-malarial, the case returned as enteric being of a doubtful character. No doubt they were all of the same type.

Ceylon.—Strength, 1,077; ratio of admissions, 85.4; of deaths, 7.43; of constantly sick, 4.50. Here, as in Bermuda, the whole of the admissions range themselves under three heads—enteric fever, ten, with seven deaths; other continued fevers, sixty-seven, no deaths; dysentery, fifteen, with one death. Four of the cases of enteric with three deaths occurred at Colombo, and six with four deaths at Galle. The disease is said to be endemic at both places, and the towns riddled with cess-pits.

China and the Straits Settlements.—Strength, 2,266; ratio of admissions, 55.2; of deaths, 1.77; of constantly sick, 2.98. Of the admissions, five with three deaths were from enteric fever. Nine cases occurred at Hong Kong, but in no instance did two cases come from the same barrack. Nothing could be discovered within the precincts of the barracks to account for their occurrence. The remaining three cases were, one from board ship, disembarked two days prior to admission, one from Kowloon, and one from McGregor barracks, the origin of which could not be traced. Of the six cases in the Straits Settlements, three occurred at Tanglin and three at Penang. Several cases are said to have occurred among the crews of the ship, in which two of these men had recently arrived from the Cape. There were also forty-five cases of simple continued fever, and twenty-four cases of dysentery with one death, but these diseases did not assume an epidemic form, and being mild in type, and below the average in numbers, do not call for further notice here.

India furnishes some very interesting facts regarding the group of diseases under review. I shall give the details by Presidencies; and first of—

Bengal.—Strength, 40,921; ratio of admissions, 131.5; of deaths, 7.04; of constantly sick, 6.53. There were 538 cases of enteric fever, of whom 166 died. These cases were distributed over fifty-five stations, in numbers varying from one each at ten stations, two each at four, three each at three, four each at two, five each at two, six each at five, seven each at six, eight each at two, nine each at two, ten at one, eleven each at two, twelve each at two, fourteen at one, eighteen at one, nineteen at one, twenty at Roorkee, twenty at Ranikhet, twenty-one at Sialkhot, twenty-two at Allahabad, twenty-three

at Chaubuttia, a like number at Fyzabad, twenty-eight at Meerut, twenty-nine at Rawal Pindee, to seventy-nine at Lucknow. Calcutta escaped altogether.

Having regard to the relative strength of these several garrisons, it cannot be said that the disease was epidemic in any of the stations, with the exception perhaps of the last. The admissions at Lucknow are, however, lower by twenty-five than in the previous year. The reporting officer says: "In no case was the disease satisfactorily accounted for, and it seems almost impossible to imagine that insanitation in the barracks or lines could have originated any of the attacks." Of the numerous cases occurring at Fyzabad another officer writes: "Some were extremely severe, and all, with one exception, were in young soldiers between twenty and twenty-three years of age, whose average service in India was a year and three months. The disease could not be traced directly to any local insanitary condition, nor to faults in food or milk, and the fact of the rareness of attacks among women and children, as also noticed last year, would seem to exclude milk as a possible cause."

There were thirty cases of small-pox with two deaths, 143 cases of other eruptive fevers, chiefly dengue. The majority of these cases occurred at Umballa, where the fever is said to be endemic, and of a malarial type. There were 3,483 cases of continued fever with five deaths, being below the average of previous years. There were 135 cases of cholera with ninety-two deaths, being considerably in excess of the average ratios of the previous five years. Eleven cases with ten deaths occurred on the line of march, ten with five deaths at Lucknow, twelve with seven deaths at Ranikhet, thirteen with ten deaths at Meerut, seven cases with four deaths at Meean Meer, twenty-three cases with ten deaths at Peshawur. The disease was generally prevalent among the civil population. There were 984 cases of dysentery with twenty-two deaths, but the disease was not so prevalent as in 1886.

Madras.—Strength, 11,783; ratio of admissions, 137.9; of deaths, 4.60; of constantly sick, 9.90. Here, also, as in Bengal, enteric fever is conspicuously present, accounting for thirty-five of the fifty-three deaths under this sub-group. The distribution of the disease was also very general, but, as in Bengal, the number of cases in the several stations bears no fixed proportion to the strength. Madras and Poonamallie escape altogether. Wellington, Belgaum, St. Thomas's Mount, show one admission each, Malliaporum and Rangoon two each, Kamptee six, Bellary eight, Bangalore thirty-one with eleven deaths, and Secunderabad ninety-one with sixteen

deaths. More than half the cases occurred at Secunderabad, the great majority of those attacked belonging to the 7th Hussars, recently from England, and largely composed of young men. It must be borne in mind, however, that the number attacked in 1886 was nearly as large, being seventy-six with twenty-five deaths, although age and recent arrival in the country could not be said to have exercised any marked effect on the prevalence of the disease. It is stated that the latrine arrangements were not altogether satisfactory; but no definite opinion regarding causation either here or at Bangalore is recorded.

There were seven cases of eruptive fevers other than small-pox, 708 cases of continued fever with one death, eight cases of cholera, all fatal; and diarrhœa was epidemic at Trimulgherry and Secunderabad in July and August, cholera being also prevalent in the villages round Secunderabad at the same time. There were 729 cases of dysentery with eleven deaths, the greatest prevalence being in the Hyderabad Subsidiary Force. The admissions in Secunderabad alone amounted to 309, or more than two-fifths of the total number, but no deaths occurred at that station. This speaks highly for the modern treatment of this formidable disease.

Bombay.—Strength, 11,238; ratio of admissions, 130.8; of deaths, 7.0; of constantly sick, 7.05. Here, too, enteric fever caused within a fraction of half the deaths from all diseases under this sub-group. The actual numbers are—small-pox, 1; other eruptive fevers, 4; enteric fever, 127 with 38 deaths; other continued fevers, 1,057 with 2 deaths; cholera, 39 with 28 deaths; dysentery, 244 with 9 deaths; other diseases, 2. The distribution of enteric fever was as follows:—Colaba 2, Deesa 6, Karachi 19, Hyderabad 1, Poona 7, Kirkee 3, Ahmednagar 12, Mhow 56, Nasirabad 21. The reports contain nothing definite regarding causation.

There were 1,057 cases of continued fever with two deaths, thirty-nine cases of cholera with twenty-eight deaths, and 224 cases of dysentery with nine deaths. The cases of fever were of the usual type and frequency, the highest ratio of prevalence being in the Bombay district. Cholera was epidemic at Neemuch, where twenty-three cases and seventeen deaths occurred. There were eight cases at Mhow with five deaths. Isolated cases occurred at six other stations, showing the presence of a so-called epidemic influence kept in check by judicious sanitary arrangements. Dysentery was not so prevalent as in Madras, but it was rather more fatal, although here, also, the results of treatment are satisfactory.

Egypt.—Strength, 5,272; ratio of admissions, 292.5; of

deaths, 8.72; of constantly sick, 16.17. Here, again, enteric fever accounts for thirty-seven of the forty-six deaths recorded under this head, the remaining fatal cases being small-pox four, dysentery five. Thirty-two cases of eruptive fevers other than small-pox, and 1,092 cases of fevers other than enteric, were treated without a single death. Enteric fever is attributed to local insanitary conditions. When the Nile was at its highest and began to fall, the greatest number of admissions occurred. "As the river rises it percolates the soil and disturbs the filth in the ground, and also the cess-pits with which Cairo abounds. The insanitary material is pressed to the surface, and under the hot sun poisonous emanations rise into the air." So writes the medical officer in charge, but with such sanitary, or rather insanitary, surroundings it is just possible that here also the water-supply may be contaminated. The admissions at Abassayeh were less by one-fourth than the previous year. The medical officer in charge does not attribute this to improvements in sanitation, but rather to the fact that the troops were for the most part resident, as it were, in Abassayeh during the year, and not, as in previous years, a garrison composed of a fluctuating population passing up and down the Nile. The decrease at Ramleh is similarly accounted for, the bulk of the force being seasoned troops, quartered in good barracks, more settled, and better fed.

The almost uninterrupted presence of small-pox in a virulent form subjects the troops in Egypt to a danger which, but for vaccination, would be a formidable one. Judging from the number of cases recorded—twenty-six admissions and four deaths—it is obvious the efficiency of our system of vaccination and revaccination has been severely tested. Possibly a careful scrutiny of individual cases might elicit evidence of want of thoroughness in the operation in some instances, but on the whole the results are by no means unsatisfactory.

The prevalence of continued fevers is ascribed to local insanitary conditions, largely influenced by the rise and fall of the Nile, a remark which is equally applicable to dysentery.

A comparison of the data that I have now laid before you, in what may possibly be considered unnecessarily minute detail, with the sickness and mortality in the army from this class of diseases thirty years ago, shews, I think conclusively, that a considerable advance has been made in lessening their prevalence in all parts of the Empire. They also seem to warrant the conclusion that the most successful

as well as the most practicable method of preventing these diseases is thoroughly efficient sanitary supervision of the men and their surroundings. Purity of air and water, wholesomeness and sufficiency of food and clothing carefully adjusted to the requirements of climate, and the nature of the duties demanded of the troops, are of course first essentials; with which should be included roomy, well-ventilated and lighted barracks, free from any approach to crowding, especially in dormitories, and the most scrupulous cleanliness in every detail of domestic economy. These are the principles which guide the medical officers who are charged with the sanitary supervision of the army, and, in so far as the means at their disposal admit of their application to the varying needs of the troops, they leave nothing to be desired. I do not of course overlook the great importance of isolation and disinfection in contagious diseases, and more especially in those depending upon a specific poison thrown off by some organ or part of the patient. In such cases the contagia should of course be intercepted and destroyed at their source, or as soon after their escape from the person of the sick as possible. Underlying these principles, however, there are others which must not be overlooked, and on which the facts laid before you seem to throw light.

First and most conspicuous among these is the etiology—the true cause—of these diseases; and in discussing this point my remarks will be limited to enteric fever, the great importance of which is shewn by the destruction of valuable lives at an age when they are developing into the full vigour of manhood. Enteric fever is usually attributed to a specific morbid poison which is reproduced, multiplied, and given off by the stools alone during the course of the illness. The contagium is further stated upon high authority to be a specific typhoid bacillus. Bacteriology has made such rapid strides of late years in throwing light on obscure points of etiology and pathology that men are beginning to regard it as a likely means of solving many of our existing difficulties in regard to this subject of causation. But the admirable lectures on the relationship between chemical structure and physiological action, recently delivered before the Royal College of Physicians by Dr. Lauder Brunton, are calculated to make us hesitate to accept the microbe as the ultimate factor in the production of this disease. Possibly even the ptomaines may eventually be found to depend upon some perverted vital function, rather than upon the bacillus which may have found a temporary home within the system.

At all events, assuming that the cause is a specific one, and

that every case of enteric fever must, therefore, have had an antecedent one, how are the numerous instances which I have laid before you, in which single cases, or a very small group of cases, springing up among given bodies of men far separated from each other by distance, but of a common race and age, and following common pursuits, to be explained? In many instances no progenitor or successor could be traced, while in an equally large proportion of outbreaks no connecting link was discovered. Neither the specific poison theory, now much favoured, nor the pythogenic theory alone, seems capable of accounting for these isolated cases regarding which I still hold to the opinion expressed in my report of 1880, that there are facts encountered in practice, and especially in India, which it is difficult to reconcile with any of the theories favoured by European pathologists. The occurrence of cases of enteric fever among troops previously free from the disease, at posts and camps which were in all human probability occupied for the first time during the campaign in Afghanistan, is the most striking of these, and is hardly explicable on any theory short of origin *de novo.*

There is, no doubt, a great mass of evidence which points to the existence of a previous case, from which the poison may have been derived in certain outbreaks in civil life; but in the army, at least, such evidence is so often wanting as to create a doubt not easily satisfied. Dr. Broadbent seems to think that to admit the correctness of the pythogenic hypothesis, with which I would associate self-infection, involves the admission of the origin *de novo* of small-pox and all other contagious diseases. This seems to me to assume that enteric fever is contagious in the same sense that small-pox is so, and that other admittedly contagious diseases, such as typhus fever, diphtheria, etc., cannot spring up *de novo,* neither of which has, so far as I am aware, been quite conclusively established. At all events, whether the cause be a specific poison, a bacillus, or some product of putrescent organic matter existing in the body, or introduced from sources external to it, we may accept as probable at least that, in the case of enteric fever, the cause is nurtured and propagated by filth, the removal or destruction of which is fatal to its existence.

But the points in which this Society is more immediately interested are the causes which contribute to the epidemic prevalence of these diseases, and the best means of removing them. Putting aside for the moment climatic influences which are not under our control, these seem to be local and personal, and in the front rank I would place overcrowding

and filth. Overcrowding is of course a relative term depending largely for its injurious effects upon the quality and construction of the edifice, the sufficiency or otherwise of its ventilation and lighting, and the condition of the site on which it stands. Filth here indicated, on the other hand, is not merely "matter in a wrong place", as defined by Lord Palmerston, but animal and other organic matter in close proximity to individuals, or their dwellings, while undergoing those degenerative changes which eventually resolve it into its elements, or into other inert compounds. Where these conditions exist zymotic diseases readily assume epidemic intensity, while, local conditions and sanitary surroundings being satisfactory, the epidemic dies on its birthday.

While disposed to concur with those who view enteric fever as capable of being stamped out when it occurs, and of being prevented altogether by sanitary measures directed against filth, there are other members of this group which are apt to become epidemic under favourable circumstances, and for the prevention of which more vigorous measures are necessary. When and under what circumstances do the contagia of such diseases germinate, if they be organic entities depending on germination or some allied process for their existence, and what are the predisposing causes at work among communities in which they find a genial soil for their development? Is it clear that the specific causes, whatever they be, of the several diseases which are prone to assume an epidemic form, are self-existent entities always present with us, but impotent to assail us, so long as we enjoy a vigorous frame and a healthy environment? In other words, are the conditions, social and sanitary, under which we live, and the physical development they produce, elements in the complex questions of the origin and spread of disease, and therefore worthy of the attention of the epidemiologist? If physical differences in individuals are found to depend on varying physical conditions under which they grow up, may it not be possible—nay, probable—that these latter have also some influence in warding off, or predisposing to disease, the various communities among whom epidemic and endemic diseases prevail? At all events, it may be well to glance at such conditions as are known to influence development, and to see how far these are identical with those which are held to favour or check the spread of epidemics.

"If we inquire," writes Buckle, in his *History of Civilisation*, "what those physical agencies are by which the human race is most powerfully influenced, we shall find that they may be classed under four heads, namely climate, food, soil, and

general aspect of nature." After analysing the separate and combined influence of these agencies over the fortunes of man, Buckle proceeds to show the order in which the human race advances in civilisation, and in moral and intellectual development, "man modifying nature and nature modifying man, while out of these reciprocal modifications all events must necessarily spring." If this be so, may we not reasonably inquire whether man's proneness to suffer from epidemic and endemic diseases is not more intimately associated with the physical conditions by which he is surrounded, and which he has been an active agent in shaping, than is generally realised?

Whatever views may be held in regard to racial differences in the inhabitants of different countries, and even of districts of the same country, few will refuse to admit the influence of the agencies referred to on the physical development of the people in all countries. Climate and soil are essential to, and mainly instrumental in, the production of food; and this again, with what Buckle calls "the general aspect of nature", shapes to a great extent man's physical as well as his moral and intellectual development. "Racy of the soil" is perhaps less applicable to the inhabitants of these islands to-day than it was a century ago, when men for generations inhabited the same hills and valleys, and subsisted mainly on the products of their native soil. Now men aggregate in great cities, and subsist on the food-products of other countries to a much greater extent than they did even half a century ago, and the results are perceptible not only in modifications of the types of disease prevalent among them, but also to a still greater degree in a less robust physical development. It is only necessary to visit the centres of our manufacturing industries, and the slums of our great cities, to realise this, notwithstanding the great advances which have been made of late years in ameliorating unfavourable conditions as to health, still too commonly met with among the lower orders of our large towns. Free trade and cosmopolitan intercourse are rapidly placing the different races of men more nearly on a common platform as regards food at least; while the ever-widening sphere which improved means of human intercourse is daily opening up, offers attractions for the physically strong and mentally vigorous, who thus carry to other countries, and happily to our own colonies in the main, the flower of our youths, leaving the less vigorous, the halt, the maimed, and the blind, to struggle on and perpetuate the race at home.

The history of the inhabitants of these islands is not want-

ing in illustrations of the differences in the susceptibilities to disease depending upon the nature of the staple articles of food, and the consequences which flow from their use. Scotland, with its oatmeal and pease-brose, the products of its own soil and climate, has nurtured races of men in the past, whose physical and mental development, and power of enduring hardships and resisting disease, compare favourably with other European nations; while their Irish neighbours have shown a susceptibility to disease, and to typhus fever in particular, which is remarkable. Is this proclivity of the Irish to typhus attributable to the potato as a food, or to the concomitant fact, stated by Buckle, "that in a country where men live on potatoes the population will, if other things are tolerably equal, increase twice as fast as in a country where they live on wheat"? The overcrowding which this rapid increase of numbers produces, when not accompanied by an equally rapid increase of wealth, is probably a more potent factor in the prevalence of fever than the potato. Pestilence and famine, and the improved wages resulting from reduction of numbers through emigration, have done much to modify all this.

The conditions under which the English as a nation live, the rate of wages earned, and the sources from which they draw their food-supplies, are so different from the Scotch and Irish, as not to admit of any accurate comparison in these respects, at all events as regards the past; but here, too, changes in the staple articles of food, through free importation of foreign produce, and notably of meat sold to the consumer under novel conditions as to methods of preservation, may not be without their influence.

It may be well to glance here a little more minutely into the conditions under which man has placed himself in those great towns and cities of the Empire—man's modifications of his physical surroundings—and to estimate approximately, for we cannot do so accurately from the data available, the effect these have had on the physique of the people, and on their power of resisting epidemic outbreaks of zymotic disease. Time does not admit of an exhaustive examination of the conditions under which the lower orders in our large towns live, nor is this perhaps necessary, as it is a favourite subject of discussion in the press at the present time. Those who have turned over the pages of the Report of the last Royal Commission on the Housing of the Working Classes will readily admit that there are many parts of this city, and of other large towns, in which the condition of the dwellings of these classes are neither conducive to a healthy

development of mind and body, nor to a reasonable prospect of an average longevity. Of many districts of London, the late Lord Shaftesbury said, the progress made in the improvement of the dwellings of the poor was enormous as compared with thirty years ago; yet the evils of overcrowding, especially in London, were still a public scandal, and were becoming in certain localities more serious than they ever were. To take an illustration from St. Pancras—a Jews' quarter—in the words of the Rev. C. Billing, "overcrowding has not increased there simply because the district had become so full it could not grow more crowded . . . five families to six rooms will be found, in certain areas, to be under the mark rather than over it." In Lion Row there was a room, 12 feet by 6, and only 7 feet high, in which seven persons slept. At 3, Drury Street the first floor front room was 13 feet by 12, and 9 feet high, and was inhabited by a family of nine, who had only one bed. Many similar instances are given by the Commission. Bristol, Newcastle, Camborne (in Cornwall), Alnwick, and many other towns afford like examples of overcrowding.

Great overcrowding of houses in limited areas is also said to exist in many places, while the very objectionable principle of placing houses back to back, thus cutting off all possibility of thorough lighting and perflation, is a crying evil, to which Dr. Thorne Thorne and others have called public attention. Cellar-dwellings, jury-buildings, old houses rotten from age and neglect, new houses rotten from the first, are described, and the effect of the one-room system is declared to be morally and physically bad. No one has ventured to express an opinion that they are not most destructive to bodily health; but, to put this beyond doubt, the Commission give the rate of mortality in one locality as 70.1 per 1,000, adding the significant remark—No epidemic. In Wellington Square, the same year, the death-rate was 53.7 per 1,000, and in Drury Street it was 44.4 per 1,000.

One word touching the effects of such conditions on physical development. The Jews are in all countries dwellers in cities, and there is in this city a fair sample of the race, of every social grade, from the tailors of Houndsditch to the barons of Piccadilly. Of this people Messrs. Spielman and Jacob have furnished many interesting particulars, which have been fully recorded in the journals of the Anthropological Institute. I quote the following in abstract:—There are two social facts of great importance in their bearing on vitality: the vast majority of Jews live in cities; Jews have a larger proportion of poor than the people among whom

they dwell. Their longevity and vitality, so far as it is founded on the low death-rate, is attributable rather to the greater care taken of children under five, which, after all, means that more weakly individuals are kept alive to carry on an unequal struggle for existence. In a recent number of the *Jewish Chronicle* it is stated, on the authority of these gentlemen, that the curves of measurements of West-end Jews are almost identical with Mr. Galton's measurements of all Englishmen; whereas those affecting the East-end Jews are invariably below them. The measurements for height of 13,000 Jews, given by Mr. Jacob, are remarkably close to the actual measurements taken by Mr. Spielman, the mean in the former being 63.47 inches, and in the latter 63.75 inches. It is added, with regard to sickness among this people, that the most widely spread of Jewish diseases—namely, insanity, blindness, and deaf-mutism—can be traced in part to their life in towns, their mental activity, and exciting occupations. I venture to think that the insanitary, but remediable, conditions under which the East-end Jews have been shown to reside, in London at least, are important factors in producing these results.

These facts seem to be confirmatory of some deductions drawn from statistics of recruiting by me two years ago—viz., that the combined effects of emigration, which draws away the most physically fit of the working-classes to the colonies and America, and the migrations of large numbers of the same classes from rural to urban residences and pursuits, had a deteriorating effect on the lower orders from which our recruits are largely drawn. Although the subject is hardly within the scope of this address, it may interest the Society to learn that of 60,976 recruits examined in 1887, 27,571 were rejected as unfit to bear arms, giving a ratio per 1,000 of 452.16, and this, too, under a standard much below the mean of the healthy population of these islands—viz., height, 5 feet 4 inches; chest-girth, 33 inches; weight, 115 lbs. It is right to add that, of the rejections, 35.09 per 1,000 were under height, while the chest-girth for men of 5 feet 4 inches is in excess of a fair development, the correct proportion in an adult being half the height. Being anxious to ascertain whether the recruits drawn from the East-end of London were physically inferior to the average of the recruiting generally, I obtained a separate return for 1887 from the sub-district at the Tower, from which it appears that of 2,633 recruits examined, 1,316, or one half, were rejected. The chief causes of rejection were —weakness of intellect, 17; defective vision, 196; disease

of heart, 43; disease of veins (varix), 39; loss or decay of teeth, 21; hernia, 48; varicocele, 20; defects of lower extremities and flat feet, 33; disease of joints, 37; ulcers, wounds, cicatrices, and other affections of cutaneous system, 42; malformation of chest and spine, 38; under height, 93; under chest-girth, 398; under weight, 172; other disabilities, enumerated under twenty different heads, 119. Although recruited in the East-end, these men were not all natives of London. Of the total number examined, 2,505 were English, of whom 1,283 were rejected; 40 were Scotch, of whom 9 were rejected; 50 were Irish, of whom 11 were rejected; and 38 were colonials or foreigners, of whom 13 were rejected. I do not attach much value to these recruiting statistics, because the men had been already selected by recruiters, who accept none but such as they think will pass; but, such as they are, they seem to me to favour the views I have elsewhere expressed regarding the relatively inferior physique of urban as contrasted with rural populations.

As I write, the School Board of London have under consideration, to quote *The Times* of 4th November, "how best to deal with the semi-starvation of a portion of the children who attend the schools, and whose capacity to receive and profit by instruction is seriously curtailed by the pains of hunger, as well as by the want of strength consequent upon insufficient feeding." *The Times'* article goes on to say: "The committee appointed by the School Board have issued a report, from which it appears that no less than 43,000 children, or more than twelve per cent., habitually come to school in want of food." Still further on it is stated: "The basis of a child's power to learn is in the physical structure of his brain, and this physical structure is built up and sustained by food." Under such circumstances, coupled with other conditions as to overcrowding already incidentally touched upon, it is hardly reasonable to expect that children so reared can develop into men of good physique and average stature, nor can we hope that when exposed to the causes of zymotic diseases they will be able to resist them, or have a fair chance of escape from fatal consequences when so attacked.

Turning to the exhaustive reports of the late Dr. Farr for an illustration of the death-rate of urban populations fifty years ago, I find, from calculations made with care, and based upon returns of deaths for the seven years 1838-44, and the census taken in 1841, "that the annual deaths in the town districts of Manchester to 1,000 males living are

thirty-seven; in the extra-metropolitan parts of Surrey, nineteen per 1,000. To take particular ages, the annual mortality of boys under five years of age is forty-eight in Surrey, 148 in Manchester, per 1,000 living; of men of the age of thirty-five and under forty-five the annual mortality is eleven in Surrey, twenty-one in Manchester, per 1,000 living." "It is found from the returns of the seven years 1838-44 that the mortality of Liverpool and Manchester, and the worst parts of other towns, is nearly double the mortality of tolerably salubrious districts." These, and other facts which might be cited, amply justified Dr. Price—quoted by Dr. Farr—in stating, "With how much truth great cities have been called the graves of mankind!" adding, "It is by no means strictly proper to consider our diseases as the original intention of Nature; they are, without doubt, in general our own creation." It is satisfactory to find, from the returns of the present time, that the death-rate in our large towns has greatly decreased during the last fifty years. During the quarter ending September 30th, 1889, the death-rate in London per 1,000 per annum was only a fraction over sixteen; in Liverpool, twenty-one; in Manchester, twenty-four. The death-rate from the principal zymotic diseases in these cities is also low. Still we have ample evidence that our large towns offer numerous instances of a death-rate far in excess of what it should be. In Plymouth, for example, the rate for the last quarter was 26.6, the deaths from the principal zymotic diseases being ten per 1,000. In Preston the death-rate was thirty-three per 1,000, 12.0 of which was attributable to zymotic disease; and in Newcastle-on-Tyne, 27.6 per 1,000, 5.3 of which was from zymotic disease.

The pressing need still existing for continuous effort on the part of this and other Societies having for their object the improvement of the sanitary condition of all classes, and the results already obtained in reducing the death-rate in certain large towns, encourage the hope that further energetic efforts in this direction will be abundantly rewarded. The death-rate is not a full measure of the injury inflicted upon the people by the presence in their midst of remediable causes of disease. Dr. Farr has pointed out that every death may be taken as representing two persons constantly sick, to which must be added the cost of subsistence and medical treatment while so disabled, before any estimate of the impoverishing effects of preventable disease can be formed. No stronger argument could be used in favour of the rigid enforcement of all laws having for their object the prevention of disease, and the physical well-being of the people.

Let me advert briefly to the Infectious Diseases Notification Act which has just come into force, and which places on the medical profession the responsibility of fixing the limits within which the law is to be enforced. No doubt the Act, judiciously administered, will contribute largely to the prevention of contagious diseases; but it is equally clear that its enforcement upon all classes, the poor especially, will be both onerous and difficult. It is of great importance, therefore, to determine with precision what diseases are really capable of communication to others by contact or personal intercourse only, and, therefore, demanding isolation for their prevention; and what are merely filth-diseases capable of being stamped out by cleanliness alone. I venture to repeat here what I stated on this subject some two years ago: "Do the so-called filth-diseases, many of which are said to be contagious, really require isolation; and are we justified in calling upon the State to insist upon due provision being made for such isolation? In my judgment it is the filth that should be isolated, and not the unfortunate sufferer from filthy environments. And here I see a pressing need for clearer views regarding causation. Let this point be once determined, and much of the difficulty of dealing with so-called contagious diseases will have vanished. In certain diseases depending upon known specific poison, the laws governing the multiplication of such poison, the conditions under which it can retain its infectivity, the pabulum, so to speak, on which it lives, and the vehicles by which it is distributed, all demand more attention than they have received. When all existing doubts have been removed, and when we are able to say unhesitatingly, here is a case in which neither disinfectants nor the utmost attention to cleanliness will safeguard the healthy if brought into contact with the sick, the consent of the people to enforced isolation will no longer be withheld; and I may add the number of cases requiring removal for purposes of isolation will be fewer than is generally supposed."

For these and other reasons which might be stated, it is obvious that this Society is performing a good work in keeping before the public the pressing need of the strictest investigation into the origin and spread of epidemic diseases.

MALARIA *VERSUS* MORE RECOGNISABLE CAUSES OF DISEASE.

By SIR WILLIAM MOORE, K.C.I.E.

(*Read: December 11th,* 1889.)

THE diseases which malaria has been supposed to cause or aggravate comprise almost the whole of the nomenclature. In addition to the so-called malarious fevers—intermittent and remittent—abdominal complaints, as diarrhœa, dysentery, and even cholera, have repeatedly been attributed to malaria.

Various authors, and especially the late lamented Chevers, have theorised the possibility of sudden attacks of epidemic heat apoplexy being caused by concentrated malaria, and the deadly effects of the desert simoon have also been attributed to malaria.

Other maladies which have been theorised as caused by malaria are convulsions, especially in children, epilepsy, hysteria, neuralgia, sterility in women, impotence in men, rheumatism, gout, anæmia, lesions of central nerve-structure, with many more which it would be tedious to mention.

In short, what MacCulloch wrote long ago has been more than endorsed. MacCulloch said: "Malaria produces a far wider mass of human misery than any other cause of disease; it is the cause of far more than half the mortality of mankind." It really puts one in mind of the 122nd proposition of the Brunnonian system, which asserted that debility is the cause of intermittent as well as of every other kind of fever; or of the homœopathic theory, which referred everything to itch! The importance of some decided and rational idea as to what malaria really is cannot be over-estimated. But it is necessary to distinguish the dry bones of fact from the drapery of theory.

Unfortunately this dire agent is imponderable, invisible, and unrecognisable by chemical or any other test. All that is asserted regarding the characteristic and habitat of malaria is deduced by inference from presumed consequences. It has been supposed to be a vapour; it has been theorised to be a manifestation of electrical or magnetic phenomena; or

a product of volcanic action; a compound of hydrogen and oxygen; carbonic acid alone; sulphuretted hydrogen; the absence of ozone; spores of algoid plants; and lastly, a bacillus.

Now, from the time of Galen and Celsus, the neighbourhood of marshes has been regarded as unhealthy, and as causing so-called malarious fevers. But these old authors did not advance any theory of a specific poison, although they dwell upon atmospheric vicissitudes. The specific poison theory of vegetable origin must be credited to Lancisi, who in 1745 published his work, *De Noxus paludum effluvius*, and his idea of malaria being a product of vegetable decay received wide credence.

But this author states that out of a party of thirty who had sailed to the mouth of the Tigris, twenty-nine were attacked with ague on the wind changing and blowing over a marsh. Now it has been stated over and over again that malaria is destroyed by passing over a very small surface of water. I am therefore inclined to attribute the ague to the wind rather than to malaria. Lancisi's theory, that malaria is a product of decaying vegetables, could only hold ground for a period, because it was quickly observed that the fevers supposed to be caused by malaria were prevalent in other localities.

But as showing how teaching of the schools adheres, I will quote Dr. Sullivan, who wrote in the *Medical Times* of 1877: "Malaria is confined to certain localities in low, moist situations covered with rank vegetation subject to constant decay and putrefactions, acted upon by a hot sun." Now this is not the case. It has been proved that mangrove swamps do not produce any poison. Livingstone said they did not suffer more in mangrove swamps than elsewhere. Neither tanners nor market gardeners, who are much exposed to vegetable emanations, suffer especially from fevers. Dung-hills do not give fever to farmers and stablemen. Preparing the sunn plant in India does not excite fever. The masses of decaying vegetable matters about indigo factories do not excite fever; stinking, decaying mowah flowers do not give fever. Preparing flax in Ireland is not specially unhealthy, although very offensive.

Malarious fevers are quite as prevalent in the semi-desert districts of Western India, where there are no marshes, as in the Konkan, where during a great part of the year the country is all more or less marsh. In an article headed "Marwar, the Land of Death", published some years ago in the *Indian Annals of Medical Science*, I thus described the semi-desert

country: "From one extremity of its vast expanse to the other, the greater portion is little better than desert. . . . . Excepting during the scanty monsoon, the country is dry, brown, barren, and dessicated, as want of water and a tropical sun can render it. Should a tree perchance exist, it merely adds to the general desert aspect, the leaves being constantly torn away to feed passing camels, the bare branches appearing ghastly and unnatural as if blasted by lightning. Here and there a patch of green marks the site of a happy village, where water from the monsoon rains of four, five, or six inches still lingers. Here and there a dull spot marks the site of a village, where the only water procurable is from the village well, three, four, even eight hundred feet deep.

"While thinking how very different this is from that which poets feign and picture as the luxurious East, we observe the scene change. It is the month of April, the commencement of the hot weather, which both by night and day will soon displace the comparatively moderate day heat, and the bitter piercing night cold of the winter season to which this tropical sandy country is subject. A haze suddenly appears in the south-west, and increasing, assumes a dead, murky-yellow colour, and quickly half the sky and earth are engulfed in obscurity. It is the first blast of the hot wind. It soon reaches our position—a dull, roaring, whistling sound, a sensation of cold, a feeling of irritation about the eyes, and the change of colour of any dark garment tells us we are within range of the first dust-storm of the season, which will soon prevail night and day, till the inadequate monsoon rain again moistens the atmosphere, rendering it for a brief period saturated comparatively with damp. The hot, howling wind, the blinding sand, the gloom arising from an obscured sun, occasional glimpses of long stretches of wilderness, the depressing solitude, and, perhaps, a reddened stone or small temple on our coign of vantage, with hideous figure devoted to the goddess Matha, or small-pox, forms a whole scarcely to be witnessed elsewhere. Yet the inhabitants love their country, and, after acquiring money in more fertile parts of Hindustan, return to the semi-desert, where, in lieu of the luxurious vegetation of other parts, the products of the soil are a few stunted accacia bushes, or the zigyphus on which the camel feeds, and scanty grass in the monsoon."

In a recent official report to the Government of Bombay I thus described the Konkan country: "This vast tract of country, which stretches from the Malabar coast to the distant ghats or mountains, is intersected by numerous tidal rivers and creeks, large and small; the rainfall averages about

eighty inches; it is exposed to the diurnal sea-breeze, which suddenly displaces a hot, humid, stagnant atmosphere; water is only a few feet from the surface, the soil is black and alluvial, the principal cultivation is paddy or rice, and the people, suffering from so-called malarial diseases and abdominal complaints, require a dispensary in every one of the numerous villages.

"Nothing can contrast more strongly than the low-lying, swampy, humid, coast districts of the Konkan, and the comparatively elevated and excessively dry and sandy plains of Marwar. Yet so-called malarious fevers prevail in almost equal intensity, in ratio to population, in both districts.

"Further, the province of Gujerat, which intervenes, and which in the south approaches in climatic characteristics to the Konkan, and in the north to Marwar, but which altogether is neither so extremely arid as the latter, nor so extremely humid as the former, exhibits a smaller percentage of fevers. The Deccan, the mildest climate of all, where the heat is never so intense as in Marwar, where the humidity is less than in the Konkan, and where the vicissitudes of temperature are smaller than in either, exhibits the smallest proportion of malarious fevers. Such facts evidence that so-called malarious fevers are intimately associated with climatic conditions. The fact is, most writers confound climatic influences, which include heat, cold, damp, and vicissitudes of temperature, with malaria." As Maclean truly observed: "The effect of heat and moisture of tropical climates is to produce anæmia, to relax and enervate the whole system, to destroy the tone of the stomach and bowels, and to cause a constant tendency to diarrhœa, dysentery, and visceral engorgement." But the effect of heat and moisture is something more than this. An additional effect is the production of so-called malarious cachexia and malarious fever, as I shall endeavour to demonstrate further on.

Now, the occurrence of fever on sandy soils has been sought to be explained under the theory of poisonous emanations from organic decomposition. Surgeon-General Maclean says, what I believe to be quite correct, "In all cases the soil will be found to contain a considerable proportion of organic matter, and water will be found not far from the surface." Again, Maclean says: "Many of these desert places do contain organic matter, and are in reality so full of vegetative energy that water is only wanted to fit them for the productive labour of the husbandman"; which surely involves a contradiction to water being not far from the surface. Also he says, that lands in India now supplying

harvests would, if water were withdrawn and cultivation withheld, quickly relapse into deserts, fruitful only in malaria. For Dr. Maclean is one of those who imagine that if the "vegetative energy" of the soil—whatever that may be—is not expended by the growth of its natural "crop of plants", or, in a word, "healthy vegetables", the soil will produce malaria, or, as Leon Colli expressed it, be productive of telluric intoxication. But certainly vegetative energy must be expended even in the production of weeds. Moreover, cultivated vegetables are *not* the natural growth of the soil, and weeds may be as healthy as any other variety of the vegetable kingdom. And the assertion is not compatible with facts. The highly cultivated plains of Lombardy are malarious. In America, the West Indies, and China, malarious fevers exist with a high state of cultivation. And malarious fevers are never absent from populous, fertile, and highly cultivated plains of India.

Neither in the sandy districts of Western India is there the underlying surface of other sort of soil capable of retaining water by which some have sought to explain the malariousness of sandy soils. For the surface is sand, and the under surface sand compressed into stone, till after three or four hundred feet deep dry gravel and pebbles are arrived at, which appears to demonstrate that the whole country was once the bed of the sea.

Again, Chevers attempted to explain the malaria of sandy soils by saying, "All decomposable matters which the floods deposit upon the surface of the sand, not finding any neutralising agent there, undergo disintegration on the surface, and pollute the atmosphere." But Chevers never was in the sandy semi-desert districts of Western India, over which I travelled for years, perhaps more so than any medical officer ever did. Chevers' lines were cast in more fertile, pleasant places than the sands of Western Rajpootana—the States of Marwar, Jeysulmere, Bickaneer—where there are no floods, where there is little or no organic matter to decompose, where water is hundreds of feet from the surface. If what Ranking stated were true, that "every tree is a malaria trap, and every blade of grass in its decomposition vitiates the atmosphere", it would not explain the malaria of these sandy soils of Western India. For trees are few and far between, their leaves, as before stated, are devoured by camels, and every particle of grass is consumed by the herds of half-starved cattle, while their excrement is used as fuel, for there is little or no wood, and coal is unknown. Sand under a burning sun is very hot, and during the night it is

comparatively very cold; an alteration of temperature, intensified by the fact that sand-tracts are generally wild, bleak, and without shelter. Moreover, sand always retains a considerable degree of damp. If, as at Walcheren and other places, there is a substratum of water-holding soil, dampness will be still more copiously added to the atmosphere.

But rocks have often proved malarious. Ferguson tells us that during the Peninsula War fevers prevailed on rocks where, from the nature of the surface, the very existence of vegetation was impossible. We do not, however, require to go so far back as the Peninsula War for examples of fevers on rocky sites. The sun-baked rocks of Aden, where vegetation does not exist, and where water is a luxury, is one of the last places where one would expect to meet with marsh malaria, but diseases attributed to malaria occur often enough at Aden. Such maladies have so prevailed in the French Algerian possessions that Dolomein designated fever *la maladie du granit.* It has been theorised to result from the decay of a fungus which grows on granite. But fever prevails on the granite rocks of Mount Aboo, in India, where I was stationed some time; and although there is no doubt that a fungus does grow in the crevices of granite, the quantity of vegetable matter thus decaying would not probably be more than a grain to a square yard annually, and to suppose that this would contaminate the breezy height of a granite mountain is to my mind absurd. As little tenable as the late Sir Ranald Martin's theory, that fever occurring on ferruginous rocks was caused by the disintegrated hornblende becoming magnetic.

Now there is only one condition always associated with the occurrence of fevers on bare rock, and that is great diurnal range of temperature, leading to rapid radiation of heat after sunset, and copious deposits of dew. A rock which during the day may show a temperature almost sufficient to cook a mutton chop, may be 30° or 40° in the middle of the night.

I will now enumerate a few objections to and contradictions of the malaria theory.

If it be true that malaria is generated in the greatest abundance in marshy ground, because it contains a high percentage of organic matter, a rice-field should be the most deleterious. The required drying surface, the decaying vegetation, the rich alluvial soil swarming with organic life, are all present. It is, therefore, rather perplexing to find those authoritatively enunciating the habitat and charac-

teristics of malaria are not agreed as to whether rice cultivation is unhealthy or not! In Italy, rice cultivation is not permitted within a certain distance of inhabited places. In India, both rice and sugar cultivation, which should be even more malarious, have no restriction placed upon them. In Poona, for instance, within the limits of the station, there is much sugar cultivation. All this under the advice of experts. Now whether or not rice cultivation is unhealthy depends on the local climate. Rice cultivation in Northern India, where the climate is comparatively cold, especially at night, is, I believe, unhealthy, because it reduces the ground to the condition of a swamp, and at night it gives rise to damp cold. In Southern India it is not so unhealthy, unless in the influence of the sea-breeze, because, although damp arises from it, the day and night temperature is more equable, and reduction of temperature occurs from covering a large surface with water, rendering persons less liable to chill.

A similar conflict of opinion is found regarding salt-water marshes, and the same explanation, I think, applies.

Malaria has been stated to lose its noxious property by passing over water. It is curious that those endorsing this statement account for the sickly climate of Sierra Leone by the marshy character of the opposite Bulam shore.

It is stated that in certain tropical climates, safety is secured by sleeping on board ship. When such evidence is analysed it will be found to resolve itself into the facts, that individuals who have been exposed to exertion under a tropical sun on shore, or to the chilling damp of night, or to both, have suffered more than those protected on board ship, where there is not the chilling influence of terrestrial radiation.

Malaria, it is said, may be wafted in the air with fogs and mists. The number of feet it may thus spread horizontally has been even stated. On the other hand, the deadly effects of the desert simoon, which travels hundreds of miles, have been attributed to malaria. If malaria is capable of being thus definitely conveyed by the winds, it must be definite and ponderable, but those thus mentioning its spread have regarded it as of a gaseous nature, forgetting the law of the diffusion of gases.

It is comforting, however, to be told that trees stay the horizontal progress of malaria. According to some authors, we have nothing to do but to plant a row of trees between ourselves and a swamp to prevent any evil effects. Authentic instances of the kind cannot be found. The Indian stations

where this was attempted—Berhampur, Peshawur, Gooruckpoor, Jacobabad—are not especially noted for salubrity, rather the reverse; and at Jacobabad most of the trees planted years ago have been cut down recently, under the plea that they rendered the locality unhealthy.

Malaria is supposed to be most powerful at night. I quote from a writer on the subject. He says: "In all localities, and in all seasons, it is after sunset that the malarious influence prevails"; but he adds: "most so when a cold night follows a hot day." He also says, "Perhaps the most constant factor relating to malaria is, that it goes with watery exhalation and the fall of dew." It is a fact that paroxysmal fevers frequently occur after night exposure. But so do many other diseases. There are recognisable causes of disease more powerfully operating during night. There is the great fall of temperature, and there is damp. There is also the fact that the vital forces are lowest at night. There is therefore more liability to chill. There are quite sufficient reasons why disease should originate from night exposure, without reference to malaria. It is stated that malaria is of greater specific gravity than air, and that it is therefore more powerful near the surface. This is regarded as proved, because low-lying localities are least salubrious. But some have theorised that the reason why malaria is more injurious at night is that it ascends into higher regions by day.

As evidencing the greater specific gravity of malaria, it has been stated that labourers in Italy have died instantaneously from merely sitting or lying on the ground. But the most curious statement is, that in China, when drunkards fell down and lay on the ground in a state of intoxication, death was almost inevitable—"as if the poison by its ponderosity did not rise to a great height above the surface." Now to attribute the death of drunkards lying on the ground to malaria is riding the hobby rather too much! A man with brain congested by alcohol is very likely to die when exposed either to the rays of a tropical sun or to the chills of a tropical night. Then as regards persons dying from lying on the ground, there is no record of such deaths in India, where many localities are more malarious than in Italy. We do not require malaria to account for low levels being least salubrious. This is the case in all parts of the world. Upper stories are more conducive to health than basement apartments or cellars, even where malarious disease does not exist. The latter are damp and cold, and less permeated by the rays of the sun. The earth is also more liable to be wet by drainage from upper ground. We are somewhat contra-

dictorily told that malaria ascends to 400 or 500 feet in Italy; in America, 3,000 feet; in California, 1,000; in the West Indies, 2,000; in India, from 2,000 to 3,000 feet; the simple fact being that persons have experienced attacks of fever at such elevations, such being the ordinary height of hills in the countries named.

It has been advanced that malaria is in some manner or other a noxious product of the ground. On the other hand, we are told that earth is the best of destructives, disinfectants, and deodorisers.

It is stated that the first cultivation of land is always an unhealthy process, from the malaria extracted. There are other cogent reasons why this should be so. The primary cultivation of land must necessarily be conducted under difficulties and discomfort. Without efficient shelter and adequate food, sickness would prevail whether the surface of the ground were disturbed or not. Similar remarks apply to excavations for fortifications, etc., which are frequently unhealthy employments, the workmen often having to work in wet, and probably not being well housed. Road-making in India is generally an unhealthy occupation, but exposure, often bad diet, and unaccustomed work, are quite sufficient to account for this.

It is said that some natives of tropical climates are proof against malaria. It is generally asserted that the negro is proof against malaria. He may be so in his native wilds, and while pursuing his ancestral customs; for, in addition to the protection which nature has afforded him in a thick skin, with great secretory powers, he anoints himself liberally with grease; thus preventing rapid evaporation from the surface, or chill. Place him, however, under different circumstances and habits, and he suffers from fever. I have seen negroes in the Persian Gulf with fever as bad as Europeans. But they were on board a man-of-war, obliged to keep themselves clean, wear clean clothing, and could not anoint themselves with grease. No race is proof against this so-called malarious disease.

Hertz, of Amsterdam, purposely placed himself in a marshy ditch, selected on account of its putrid exhalations. He experienced giddiness, nausea, and shivering, ending in slight fever. Now I object to accept such experiments as this as a proof of malaria. Putrid exhalations, even if not from a marshy ditch, are very likely to excite giddiness and nausea. And I should think sitting in a cold ditch in addition was very likely to excite shivering, which would, as Hertz was healthy, be followed by slight fever or reaction.

The objections to the theory of a poison rising from the earth, and conveyed into the system with the atmosphere, being so many and various, a return was made to the old idea of Hippocrates and Rhazes, who asserted that fever and enlarged spleen were caused by drinking impure waters. Instances were adduced of persons drinking impure waters on shooting excursions, and suffering from fever: the exposure, fatigue, and chills consequent on such excursions not being taken into account. Now if impure water would excite fever, there are manifold villages in India where the inhabitants should always be suffering from fever. The village pond is filled by the rainwater, which sweeps with it dirt and *débris* of all kinds, which has accumulated on a large area of surface during the past eight months. In this pond natives wash their bodies, their mouths, their cooking utensils, and their clothes, and often near this pond the offices of nature are performed. In this pond cattle wallow, drink, dung, and micturate; mangy camels are washed and perspiring horses cooled. But people in such villages do not suffer more from fever than where the water-supply is better. And the time they suffer is the autumn, when the change from excessive heat by day to chilling cold at night is most marked. As an old Anglo-Indian observed: "You doctors may talk of malaria as you like, but my experience has taught me that hot days and cold nights are certain to produce fever."

A keen observer, Colonel Brownlow, Chief Engineer N. W. P., wrote: "With all deference to the doctors, I believe that the main cause of malarious fever, and one without which it cannot exist, is great diurnal range of temperature, from excessive heat during the day to chilling cold at night." Ireland, Singapoor, the Valley of the Amazon, are mentioned as exceptions to the prevalence of malaria in swampy districts. These places, so far apart, are alike only in one respect: They are remarkable for equability of climate. Something should also be credited to native opinion. No native of India believes in malaria. On the other hand, they all believe in the injurious effects of chill.

During some years of my Indian service I held the post of Superintendent-General of Medical Institutions in the extensive province of Rajpootana, and medical officer to the Rajpootana Political Agency. I used to travel with the camp of the Political Agent to the Viceroy for the Native States. We usually got under canvas in the month of October, and the number of persons in the camp varied from thirteen to fourteen hundred people. They all remained healthy until

about the 15th of November, when a sudden fall in the night temperature occurred. This was invariably immediately followed by numbers of ague and fever cases, especially among those whose duties entailed night exposure. The fever cases did not lessen until some three weeks afterwards, when the day temperature lessened. Moreover, the same occurred whether we were in the south of Rajpootana, where the country exhibits so-called malarious aspects; or whether we were in Northern Rajpootana, hundreds of miles away, where the country does not exhibit so-called malarious aspects.

Now is it reasonable to believe that this sudden accession of ague and fever, and its almost as sudden cessation, was caused by a sudden evolution and disappearance of bacillus malaria, or of any other agent which malaria has been theorised to be? I, for one, decline to believe anything of the kind.

The conclusions to be drawn are, that malaria is not the product of marshes, because its presumed effects are often apparent where there are no marshes; and there are marshes in the neighbourhood of which malarious fevers do not prevail. Malaria is not the product of decaying vegetation, as its presumed effects occur where there is little or nothing of the sort, and is not always present where there is. It cannot be a vapour, because vapours are to be detected by chemical means. It is not a manifestation of magnetic or electrical phenomena, or its effects would be produced at will. It cannot be volcanic action, or the neighbourhood of volcanoes would be the most malarious in the world; and it cannot be due to volcanic action under the surface of the ground, or miners would be especially liable to malarious fevers. It cannot be CO_2, or carburetted hydrogen, or any compound of carbon, because these compounds are to be detected by chemical means, and, moreover, such gases, obtained by stirring the mud of marshes or otherwise, have been inspired without injurious consequences. Nor can it be absence of ozone, for ozone is present in the atmosphere of marshes, and epidemics of malarial disease are not found to correspond with the indications of the ozone test proper. Nor does it appear possible that malaria is due to the spores of algoid plants of the palmella species, as surmised by Salisbury; or to the more recently discovered spores of the bacillus malariæ of Tommasi Crudelli. For malarial disease appears in all its intensity in localities where such bacilli have not the moist earth in which to germinate, and which is said to be essential.

I will recall to mind that some few years back Crudelli and Klebs announced the discovery of the *bacillus malariæ*, in the shape of small rods in the soil and water, and in the sweat and blood of persons affected by fever. Proceeding on this track, Celli and Marchiafava said the blood undergoes changes, the hæmoglobin of the red discs is removed and a hyaline material substituted. The corpuscles also soften and crenate. Laveran, as the result of continued investigation, described *leucocytes melaniferes*, or pigmented white cells, and flaggelate organisms. It is stated that certain spherical bodies in the serum, containing pigmentary granules, attach themselves to the red particles, which become pale as the parasitical elements increase. Osler, of Philadelphia, has also elaborately described the forms which exist within the red particles, and the free forms.

In brief, according to the authorities as above, malarious fevers are due to the presence of micro-organisms in the blood, which destroy the coloured blood corpuscles, and derange the normal chemical changes in the blood, developing, according to some, a toxic chemical compound.

It has been authoritatively stated that fever may be induced within half-an-hour after exposure to malaria, and that a single inspiration of malaria is amply sufficient. Others have written about malaria killing at once. Sir J. Fayrer has reported a case of malarious poisoning in Calcutta, proving fatal in a few hours. But Crudelli states that the febrile attack does not take place until the discharge of the parasite from their first habitat in the spleen and marrow of the bones has gone on to such an extent as to accumulate in the blood a vast number of these organisms. Now are we to suppose that the bacillus enters the system, finds a local habitation in the spleen or bone marrow, increases and multiplies, invades the blood and induces fever, all in half-an-hour?

Again, the bacillus malariæ has not been found by other persons who have searched for it in other countries. The fact that so-called malarious disease has prevailed on every kind of surface appears to have been overlooked or ignored by those who have endeavoured to discover the cause in one geological formation, or in one low form of vegetable organism. It is scarcely reasonable to presume that alluvial soils, ferruginous earths, decaying granite, limestone rock, marshes, salt water and fresh, dry and wet sand, all produce the same kind of poisonous emanation or of vegetable organism. If a malarious poison is really evolved from the earth, it seems reasonable to suppose that various geological structures

would produce different poisons, and, therefore, that the characteristics of malarious disease would differ. Yet malarious disease prevails on the structures named, and when typical it presents similar characteristics everywhere.

Again, everyone admits that secondary attacks of ague may occur months or years after the primary attack. Are we to suppose that the bacillus remains in the system for months and years, seeking for an opportunity to let its presence be known?

But it has been stated that inoculations have produced ague. There is no confidence to be placed in this. In a malarious country nearly everyone suffers at one time or other from ague. The very inoculation, especially if it were known what it was for, would be sufficient to excite an attack in a nervous subject, even without the hypnotic sleep and "suggestion" of which we have latterly heard so much. As regards the fever supposed to have been produced in animals, I agree with Hilton Fagge and Pye Smith, who fail to see anything definite in this rabbit fever.

I ask, as Dr. Oldham questioned with reference to Salisbury's theory of algoid vegetation being the cause, What becomes of the bacilli produced during a fever? It is said they appear in the sweat, and certainly they must leave the patient, or he would not recover. But they do not infect the atmosphere or the clothes of the patient, or the disease would spread through them. Neither do they invade the bodies of attendants, or they would be attacked, and ague would be an infectious disease. If after passing through the human body bacilli are incapable of reproducing themselves, they must necessarily exist independently in every so-called malarious locality—in marshes, swamps, sandy deserts, and barren rock, which, as before observed, it is unreasonable to suppose. The bacilli must flourish where the air is dry and where it is moist, in short, they must exist everywhere and at all times in tropical climates, and be confined in temperate climates to marshy ground.

We cannot state certainly that because a particular appearance is found in the blood of persons living in a particular locality that such is the cause of a disease. The *filaria sanguinis hominis*, which Manson believes to be the cause of elephantiasis, he admits may be found in the blood of persons not suffering from any apparent disease. Indeed, in China it is stated 10 per cent. of the population have filaria in the blood. Again, there is the spirillum, which Carter supposed distinctive of relapsing fever, found in the blood of persons not suffering from relapsing fever by Lewis.

And the flaggelate organisms described by Laveran have been found in the blood of mules and rats.

Again, there is no proof that the disease has its origin in such organisms, or that they come from without, and are not the result of changes in the corpuscles themselves. Again, we do not know that what appears in a microscope slide goes on in the blood. Moreover, Silvestrini injected dew and water in which malarious soil had been washed eighty times, with negative results.

It appears to have been forgotten that a long time ago D. M. P. Balustra described spores of a little algoid plant in the air of Rome and its vicinity, and attributed marsh fever to this "microphyte granule". This has been consigned to that limbo of untenable theories, in which I fear the bacillus malariæ will eventually find a resting-place.

Enough has been stated to show that the malaria theory, in whichever of its numerous phases it may be presented, is not, like the Grecian hero, invulnerable only at one point. Only I think we may agree with North, who in his lectures published in 1887 says: "All attempts to discover an organism capable of producing the disease, in the air, soil, or water of malarious localities, have signally failed."

I wish here to make a little digression. I have said that exposure to malaria has been stated to kill at once, and there is no doubt that persons have died in the first stage of ague, or otherwise suddenly, generally at the close of a paroxysm, from collapse. But fatal collapse may occur from chill. In cold countries—Russia, for instance—death from cold often takes place, the immediate result being syncope, asphyxia, or coma. Exposure to cold produces, in the first instance, chilliness, coldness, shivering. The general effect of severe cold is to lower to extinction all vital activity. The capillaries become congested, then so contracted as no longer to admit the onward passage of the red particles. Feeble, ill-nourished persons, or those with impaired health, or those who have been exposed to long-continued heat, are most susceptible to cold; especially if there is any old thoracic affection. In an article published some time ago in the *Indian Annals of Medical Science,* on Indian fevers, I remarked, "My experience leads me to believe that fatal syncope, or collapse, is generally connected with old thoracic changes or fatty heart." It is this effect of cold which has led to the fable of malaria killing at once.

But the votaries of malaria bring forward the periodicity of malarious diseases as an argument why there must be a specific poison. But hectic is a periodical fever, and no one

theorises it is caused by malaria. Relapsing fever comes and goes with periodical suddenness, but it is not held that relapsing fever is caused by malaria. Syphilitic fever may assume the form of a tertian or quartan ague. There is indeed periodicity in enteric, in typhus, and even in continued fever; in fact, in any fever which the ingenuity of nosologists has added to the cumbrous nomenclature. Werner, indeed, and others have described a continued malarious fever. But periodicity is in fact a universal law of nature, appearing not only in disease, but in everything else. Even the temperature of the body has periodical variations, the maximum at noon, the minimum about midnight. When a person becomes cold or chilled, the natural tendency is for the person to become warm again, or, in other words, for reaction to occur. We see this even in a common cold. Whether this will be repeated in the system appears to me to depend on many causes; for instance, on temperament; repetition being most likely to happen in the nervous, irritable temperament; on heredity, repetition being most liable to happen in those whose parents suffered from so-called malarious disease; on previous attacks, which have established a habit; on mental or moral conditions, depression favouring repetition; on the condition of the blood, deteriorated blood from heat, dyspepsia, and other causes—anæmia, in fact—favouring repetition; on hygienic conditions, among which is exposure again to a slight chill, perhaps not even perceived by the patient, but to which all are so subject after a paroxysm of ague. This appears quite as rational an explanation of periodicity as Manson's, in his theory of the periodicity of elephantoid fever, which he accounts for by the presumed cause, the *filaria sanguinis hominis*, resting on the minute branches of the pulmonary artery by day, in order to suit the nocturnal habits of the musquito, which he supposes conveys the filaria and the disease it causes, elephantiasis, from one to another—a theory which some have suggested in favour of the bacillus malariæ. But, as a matter of fact, so-called malarious diseases are often no more periodic than other diseases. Even ague, the type, is often so irregular, that excepting coming and going at extremely uncertain and variable times, it loses all claim to be called periodic, for periodicity should signify regularity. Neither is there any periodicity in enlarged spleen and various other maladies which have been attributed to malaria.

Now is it not possible to formulate a cause for paroxysmal febrile diseases, and for other maladies called malarious, without summoning a hypothetical poison from a mystic

home? If we take almost any report of malarious epidemics it will be found that the persons so suffering were exposed to other and recognisable causes of disease. I take an old army medical report, and open almost at random. It contains an account of the war on the Gold Coast, where sickness was attributed to malarial poisoning. It is stated that from the time of the landing the soldiers were quartered for eight days in the castle barracks, which were "unsuitable", "out of repair", and overcrowded by "the addition of rows of beds". On the 12th of June they marched, carried their packs, and had to ford a river, and were very jaded. On the 13th they were in the sun all day fighting; at night they rested in the barracks of St. George, which, being already crowded with townspeople, afforded little opportunity for repose. The quarters were also wretchedly bad and dangerously dilapidated. It is also stated that exceptional weather prevailed, fearful squalls alternating with suffocating heat. Two or three times in the twenty-four hours rain came down in torrents, the temperature fell suddenly and greatly, and a piercingly cold wind succeeded to the exhausting heat. In the rooms, what between leaking roofs and rain driven through unglazed windows, the floors were flooded. Even with the aid of charcoal braziers neither the rooms, bedding, nor clothing could be dried. In addition, the rations were indifferent, and the men had access to the drink known as "Chain Lightning". It is little wonder that by the 31st of July 62 per cent. were ineffective. But, as before observed, the sickness is distinctly attributed to "malarial poisoning", although the details show that the result must have been the same had malaria never been invented. Overcrowding, wet clothing, and damp bedding, exposure to the sun, great and rapid changes of temperature, indifferent diet and drink, will produce disease anywhere, and especially in the tropics, where both skin and internal organs of Europeans are in an excited, debilitated condition. The characteristics of the malady arising may differ in cold countries, but there is absolute certainty that sickness will arise under such circumstances, whether malaria be present or absent.

Among civil populations, when epidemics of so-called malarious fever occur, similar causes will be found in operation. Take a sickly season in Bengal, for instance. Predisposing causes are: a population with low vitality, born of a poorly fed race, nursed by a semi-starved mother, working hard on a food diet which is semi-starvation—want of nutrition renders them prone to many ailments. The prevalence of malarious fevers is most noticeable after

the Indian monsoon. To the equable temperature preserved by the screen of clouds, which for four months during the rains has checked radiation, succeed clear skies, which at sundown allow the heat of the ground to pass rapidly away, causing a diurnal range of thirty degrees or more. But this does not represent the range to which an Indian peasant or people out in the sun are subjected. During the day such persons may be exposed to 130° or more of solar heat, the setting sun leaving them suddenly in an atmosphere of less than half that heat. In addition to this there is extensive formation of dew, leading to further depression of temperature and damp. Thus at one hour copious evaporation is required to maintain the temperature of the body below that of the heated air, while the next hour opposite physiological processes are necessitated, and the system must be compensated by a supply of heat from its own inadequate store. It has already been remarked that exposure to moderate cold excites chilliness and shivering. It can scarcely be matter of surprise if sudden reverses of important functions are repeated in spasmodic form in paroxysms of burning fever and shivering cold, as was the case with Mons. Brachet, who after bathing seven nights in the Saone, on the eighth night experienced an attack of ague without bathing. Similar conditions described above exist in the neighbourhood of Rome. North, quoted before, says: "Ill fed and worse clothed, they have to resist all day a temperature often 104° in the shade, and to sleep in a damp, wretched hovel in an atmosphere saturated with moisture, and a temperature which just before dawn may have fallen to 38 or 36, to rise in three or four hours to 100 or more."

But it may be said this does not account for individual attacks of paroxysmal fever. Now let us see how this generally occurs. The usual manner is this: a soldier, probably young, robust, and until now in good health, is brought to hospital with fever. The history generally is exposure to the sun, or to the night air, or exposure after drinking spirits, or of having been wet through. It is seldom that exposure may not be traced, with probably prior mental or physical depression, and possibly dyspeptic derangements. The skin is constantly exhaling and excreting matters noxious to the system. The bowels are constantly expelling matters noxious to the system. Mental and physical depression and dyspeptic derangements interfere with these processes, rendering the person more liable to the influence of chill. Then there is the cachexia or anæmia, generally attributed to malaria. A recent writer observes, intemperance in the use of liquor,

with subsequent exposure to cold, wet, and malaria, may be set down as the principal sources of disease. I am glad malaria is placed where it deserves to be—last. Bontius, in his advice to his pupil, Duræus, said, many diseases are owing to a cold cause; and Duræus expressed his surprise, and could not conceive how cold diseases should predominate in hot countries. I will not trouble you with Bontius's explanation, for I think it can be explained better. Heat will act injuriously both directly and indirectly. Directly, as when an immediate sunstroke is the consequence of exposure. Indirectly, in the following manner: there is an optimum of heat, which is most favourable to the well-being of both animals and vegetables. But if the heat exceeds the optimum, the reverse is the case: appetite fails, sleep deserts the couch, strength leaves the muscles, vitality is reduced, and, as a certain prelate expressed it, "One feels like a boiled cabbage."

But other influences besides this primary action on the nervous system are at work. In a hot climate the air is rarified, therefore less oxygen is taken in with each inspiration. Respiration is also slower, and it is not so much accelerated by exercise. The result is again less oxygen inspired, and less carbon expired. Owing to heat there is increased sensible and insensible perspiration, and a smaller quantity of urine; so that there may not be sufficient fluid to carry off all the effete matter which should be excreted by the kidneys, and passed in the urine. It has been proved that great heat lessens the vitality of the blood globules, which are probably disintegrated. It is also known that the liver is concerned in the removal of effete blood globules, as also of other effete material. But notwithstanding an increased action of the liver, evidenced by periodical flux of bile, there remains a substantial modification of the blood—anæmia, in fact, being more or less established. The impaired vitality of the blood and the debilitated skin render the person excessively liable to chill. Dr. Maclean said: "The heat generative powers of all victims of malaria are impaired, hence they suffer from atmospheric changes, of which healthy men would take no note." But I say, the heat generative powers of all victims of heat are impaired. There are Anglo-Indians who cannot remain three minutes in a draught, either hot or cold, without feeling chilled.

Surgeon-General Maclean further says that the constitution may be slowly undermined by malaria without marked manifestations of fever. But I say, that the constitution may be slowly undermined by heat, and that malaria is not

required to explain that anæmia from which so many residents in tropical climates suffer.

I presume it will not be questioned that chill excites the following-mentioned maladies, which, by-the-by, have been attributed to moon-stroke. Even my lamented friend Chevers gives instances of such maladies as those mentioned below being excited by chill, and Chevers was a stern advocate of malaria. Chevers says: "During a morning's open-air work in Bombay, in November, I said to myself, I am in danger from this dreadful heat. During the railway journey up the Ghauts that afternoon the heat was pleasant. Soon after nightfall we reached the summit of the ascent, and there, all unprepared, we rushed into a wind so piercingly cold, that it gave me an attack of my old Chittagong fever." Now, I have made the same journey after a morning's work in hot Bombay many times, but never did so unprepared. If opportunity allowed, I changed my dress for warmer clothing when going up the Ghauts, or I put on a top-coat. Even those who attribute the first attack of paroxysmal fever to malaria, all allow that it may be re-excited by cold, months or years afterwards. Are we, then, to believe that cold produces a sudden birth of bacillus malariæ, or anything else which malaria has been theorised to be? Chevers gives instances of facial paralysis the result of chill—of hepatitis; of tetanus; of dysentery; of cholera; of general anasarca; of ptosis; of paraplegia. And I have seen similar cases directly the result of chill. For cold, besides killing at once, by interfering with the circulation, as already referred to, may act in other ways. It may affect the extremities of nerves, and excite disease by reflex action; or it may check the secretions of mucous membranes as well as of the skin; or it may increase the secretions of the kidneys and of the bowels. We were formerly taught that congestions and inflammations were originated by the rush of blood to internal organs, consequent on its retirement from a chilled surface; and probably this teaching was not altogether incorrect. Others have regarded chill as a depressant effect on the nervous system. It has been advanced that the thermotaxic nervous system, in endeavouring to adapt itself to the needs of the body, breaks down and becomes disorganised.

It has already been remarked that exposure to long-continued heat, also mental and physical depression, and dyspeptic derangements, interfere with the elimination of noxious matter, and render the person more liable to chill. Indeed, it has been advanced that there must be some con-

dition of this kind before chill takes place. And it has been more recently considered that chill indicates disturbance of protoplasmic molecular correlations, or, in chemical language, that new bodies are evolved in the protoplasm, which act as veritable poisons; thus often adding to an already deteriorated condition of blood. However this may be, these facts are certain, viz., that a large number of different diseases are based on rigor, and that rigor or chill is often caused by changes of temperature. Why one person should get a hepatitis, or a liver-abscess, or a diarrhœa, or a dysentery, or a pleurisy, and another should contract a coryza or a pneumonia, and a third an ague or fever, may perhaps be accounted for by predisposition of certain organs to disease. Something, however, may be attributed to heredity. We know that the fœtus may suffer from enlarged spleen or from ague. Neither is it necessary that both parents should be affected by malarious disease. Two cases of ague in the fœtus, the father only having suffered from malarious disease, have recently been recorded. And I have noticed that descendants of persons, to use a common term, who have been "saturated by malaria", are most liable to malarious maladies.

But it is objected that various cold countries where changes of temperature are great are comparatively free from certain so-called malarious diseases which are present in hot countries. Those thus arguing do not sufficiently appreciate that excitement, and consequent debility of the skin, characterising residents in hot climates. A fall of a few degrees of temperature in the tropics will make a much greater impression than a fall of many more degrees in a temperate zone, the inhabitants of which have not a cutaneous surface debilitated by heat, and are better protected by their habits, clothing, and houses. After exposure to the intense rays of a tropical sun, or in the early morning comparative cold, a native will wash himself and his clothing in the open air, and, putting on his clothing wet, allow it to dry on his body. This he may do either for cleanliness, or as a religious ceremony. Neither natives nor Europeans make sufficient change of clothing with reference to either period of the day or season. Both classes often sleep in the open air, and, while unable to bear, or, indeed, not requiring, anything but the lightest covering in the first part of the night, are exposed to the early morning lowering of temperature; for, if they have additional protection at hand, they neglect using it, by sleeping on, or from carelessness. Again, many localities are spoken of and written of as of equable temperature

which are not so—the Indian sea-coasts, for example. Even near the equator, the variation between the dead calm, stagnant air of the morning, and the refreshing sea-breeze of midday and evening, is great; and I attribute much sickness to this diurnal change of temperature being met without sufficient, often without any, precaution. But perhaps the period when chills are most likely is on the commencement of the cold season, when, while the days remain hot, the nights are comparatively colder than at any other time of the year, with copious formation of dew and damp. Of the prevalence of ague at this period I have already given an instance.

But malarious fevers have occurred in other than tropical countries. In England, for example, they were once much more prevalent than they now are. But the intensity of so-called malarious fevers declines as we proceed either north or south of the equator; or, in other words, as tropical climatic characteristics become less, malarious fever becomes less. Taking the tropics, however, as a standard, we do not entirely lose tropical characteristics until cold all the year round becomes the characteristic, leading people to dress very warmly and to live on a more nitrogenous diet.

Degrees of so-called malarious disease, from the agues of Lincolnshire to the remittents of the tropics, may be estimated by degrees of solar heat, and protection against heat and cold, which implies vicissitudes of temperature. In cold climates malarious diseases are only found in marshy spots, and they are usually present in the autumnal season, that being the period when the transition from the greatest heat to the greatest cold occurs, and when there is the greatest humidity in the night atmosphere; for one of the principal features distinguishing malarious from healthy situations is the nocturnal humidity. But both temperature and the amount of aqueous vapour differ in places not very far apart, which may account for circumscribed local unhealthiness; and the lessening of the damp is the reason of localities once malarious becoming healthy after drainage.

Now the decline of malarious fever in England has been concomitant with the progress of civilisation, implying better clothing, better housing, better water and better diet, and improved drainage—in short, better protection from chill. When Englishmen maintained hundreds of stew-ponds to supply the bi-hebdomadal fish diet; when instead of carpets rushes were thrown on an earthen floor; when in the absence of glass windows night air penetrated freely; when agriculture was rude and drainage unknown, our forefathers

suffered not only from fever and ague, but also from dysentery.

It has been remarked in India over and over again that there are in most stations one or two notoriously unhealthy houses or barracks. Everyone who occupies these buildings gets fever or some other malady. Now if these houses are examined, it will generally be found that they afford indifferent protection to the heat, which renders the occupants more liable to chill and damp.

The great preventive to malarious fevers is, especially in the tropics, protection from heat in the first instance, for it is the heat which renders the surface so sensitive to chill. But damp cold has a greater power of abstracting heat than dry cold. Both fall of temperature and damp are most prevalent at night, and near the surface of the ground. My position is, therefore, briefly this, that so-called malarious diseases, as cachexia, anæmia, or blood degeneration, are caused by heat; that so-called malarious fevers are caused by sudden abstraction of heat or chill, under the influence of cold, and more especially damp cold; that chill is most marked in hot climates, because of the antecedent exposure to great heat, the anæmia and skin debility resulting from heat, and the disregard of suitable precautions; that the individual malady will be simply of a febrile paroxysmal nature in the absence of predisposition to disease of any organ; that the febrile paroxysm will be repeated or not according as temperament, heredity, habit, mental condition, anæmia, recurring chill, one or more favour such repetition.

Now, most of the standard authors reiterate what may be termed the established views regarding malaria. They are never tired of repeating the myth, which, like the lover's old, old tale, seems never to weary in the telling. But some of them do so with misgiving, like a bashful lover. For example, Ziemssen says, influences referred to above are not sufficient to account for the origin of malaria, and there must be additional causes at work thus far unknown to us. Dr. Bristowe, after mentioning the usual items about malaria: "What, then, is this agent? Is it a gas, is it a decomposing organic substance, is it a living thing? No absolute proof has yet been adduced of the truth of either of the alternatives."

In Reynolds's *System of Medicine* it is stated that no chemist has been able to demonstrate its existence. We assume its existence from certain observed effects. Malaria is believed to be the product of organic decomposition. In Aitkens's

Science of Medicine it is observed that to predicate all the facts connected with paludal diseases is not yet possible, for the variations of atmospheric temperature, the changes in quantity and nature of electric fluid, the quantity of water, the nature of the soil, the amount of vegetable matters, and their growth, form a problem extremely complicated.

Individuals who have questioned the malaria theory are numerous. I will mention a few Indian officers. There is Dr. Oldham's book, *What is Malaria?* in which its existence as an entity is denied. Dr. Veale remarks that the great contrast between the day and the night appears to account for the great prevalence of fever during October as compared with September, for conditions supposed to have an influence in the causation of malaria are more actively in operation during the last period. Dr. Lyons writes: "The established opinion that intermittent fever is due to miasm is not applicable." Dr. Bellew says: "I believe, in the first instance, that malarious fevers are always produced by chill." Dr. Planck is unable to resist the conclusion that damp is the principal cause. Surgeon-General Gordon wrote: "I feel my inability to separate and distinguish one set of influences (climatic) from another (malarial). Dr. Gunn attributed prevalence of fever to changes of temperature. Dr. MacLagan says: "No causal connection has been established between vegetable decay and occurrence of these maladies."

Now the terai or wooded district at the base of the Himalayas has been supposed to be a most malarious country; but Dr. Duka says: "In the terai the thermometer frequently stands at 120°, and at night falls to 50°, often with cold winds. But those who have good, well-built houses, affording due protection, particularly at night, against these sudden changes of temperature, keep their health as well as in almost any part of the plains of India."

Perhaps, however, keeping unorthodox notions locked in one's own breast is most judicious, as their promulgation may plunge the enunciator into metaphorical very hot water. If, however, philosophers had been content to answer problems by reference to a hypothetical agency, our knowledge of many things would have been less than it now is. It took me a good many years to learn to disbelieve what was taught by honoured professors in those far-off days when, *in statu pupillari*, I received what was told as gospel truth. I have often thought that if we could all wash in the waters of Lethe, so as to emerge fresh to the subject, the contra-

dictions involved in the theory of malaria would lead to the abandonment of the belief.

I have not time to mention further what these contradictions are, but will simply observe that all the presumed characteristics of malaria involve a contradiction. Lastly, I beg, as Plato, in his apology for the speech of Socrates: "Do not be offended with me for telling you the truth."

NOTES ON AN OUTBREAK OF TYPHUS FEVER.

By OGILVIE GRANT, M.B., C.M., M.O.H., Inverness.

(*Read: January 8th*, 1890.)

It is with a feeling of much diffidence that I venture to bring before your notice a short account of an outbreak of typhus fever which occurred last year in the town of Inverness. There are, however, one or two points of special interest in connection with the history of the epidemic which I think are worthy of being noted, and I am much pleased at being permitted to do so through the medium of this Society. The epidemic was strictly localised, so the story is a short one.

On the 25th April 1889, the Sanitary Authorities were informed of the existence of a case of typhus fever in 1, Queen's Buildings. I at once visited the locality along with Mr. MacDonald, Sanitary Inspector, and ordered the removal of the patient to the fever hospital. After an examination of the building and its surroundings, I decided to remove the rest of the inmates, consisting of two families (Donnis and Murphy), to a small-pox hospital which belongs to the Corporation, and which I have been in the habit of using as a quarantine hospital. The room occupied by the fever-patient was in a dirty condition, and was almost destitute of furniture. The patient lay on a dilapidated bed, with old bags for bed-clothing; an old table and one or two ricketty chairs completed the furniture of the room. All the inmates were removed and the house closed up that same evening. On making further inquiries, I found that in a house almost directly opposite, two members of a family named Inglis were ill; and, as there had been frequent communication between the two houses, I, along with the Sanitary Inspector, visited this house. I recognised that they were suffering also from typhus fever, and had them removed that same day to the fever hospital, and the other two members of the family removed to the quarantine hospital, and had the house closed. On the 9th May I received information that a boy (Macdonald), residing at 3, Cameron's Close, a nephew of the first patient, was ill. He had been in his

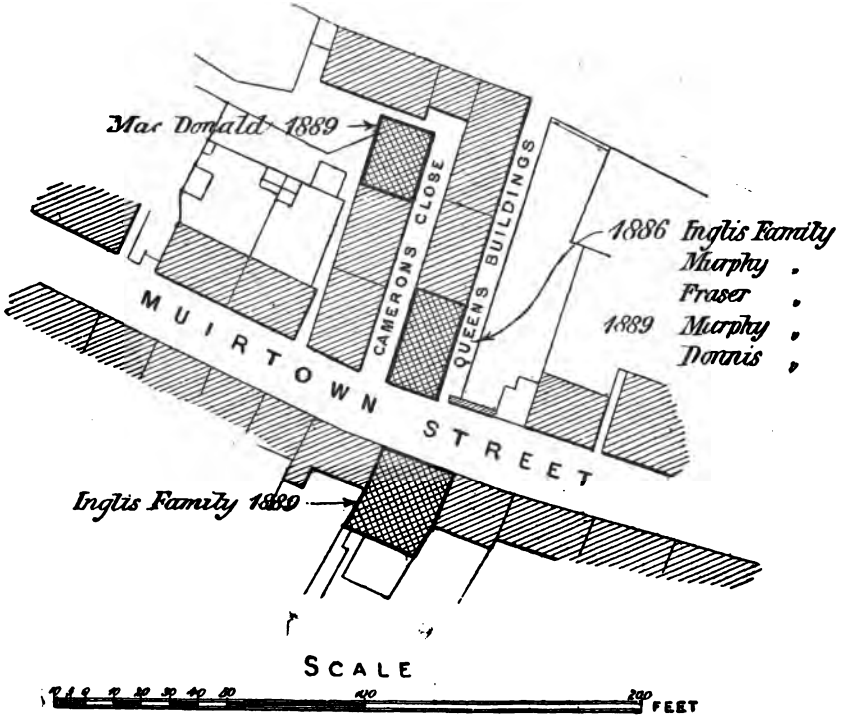
uncle's room in Queen's Buildings before his removal. This also turned out to be a case of typhus fever, so I had him removed to the fever hospital, and the rest of the family to the quarantine hospital, and had the house closed.

Mr. MacDonald, Sanitary Inspector, who was exposed to the infection on one occasion only, when he visited the house along with me, took ill on the 7th May, and, as soon as the disease was diagnosed, he willingly consented and was removed to the fever hospital. The families interned in the quarantine hospital were regularly visited by me. On the 17th May, one of the inmates, Jessie Inglis, who had been removed on the 26th April, became ill of typhus fever. I had her at once removed to the fever hospital, and no other cases occurred in the quarantine hospital. Since that date there have been no cases of typhus fever in the burgh of Inverness; the epidemic was stamped out. All the patients, I am glad to say, recovered. The most serious case was that of Mr. MacDonald, whose life was in great danger. In all cases the disease ran its usual course. As to treatment, it was carried out in the ordinary lines; I used stimulants freely. I found antipyrine of use in reducing the temperature, and sulphonal useful in quieting delirium. The measures I undertook to prevent the spread of the epidemic were very decided, and hardly legal. They were, however, eminently satisfactory, and, from experience of former outbreaks, I do not think that any measures less vigorous would have been so successful. The fact that one of the patients contracted the disease while in quarantine, three weeks after admission, showed the necessity of the measures undertaken. I had no power to shut up those exposed to the infection; but, strengthened by the active co-operation and approval of the then Provost, Sir H. MacAndrew, I felt justified in doing everything in my power to stamp out the disease. I must also say, to the credit of the patients, that, when they saw the danger they exposed the community to, they willingly agreed to go into quarantine.

One great advantage that accrued from getting all the inmates of the affected houses removed from their abodes was that I was enabled not only to get the contents of the houses either destroyed altogether or thoroughly disinfected, and the houses completely disinfected, and also necessary repairs done, but was able to leave them empty for a considerable time. When on the subject of disinfection I should like to say a word about the danger that arises from the too confident belief in some disinfectant that is loudly lauded. I have seen a pan of some antiseptic fluid placed in a room

and trusted as a sure means of preventing the spread of some infectious disease; or a sheet dipped in some antiseptic solution and hung over a door, and believed to be a barrier beyond which the disease could not pass, and all other remedial measures neglected. I would rather see these precautions dispensed with, and a greater regard paid to cleanliness and ventilation in the treatment of infectious diseases.

But to return to my story. I desire now to draw



your attention to a curious connection between this recent outbreak and an outbreak that occurred nearly three years ago. Perhaps I may have led you to infer that I was successful in my treatment of the late epidemic, if so, I must now tell you of failure. This outbreak occurred in November 1886. A family residing in another part of the town were found to be suffering from typhus fever, and at different times four members of the family were removed to the fever hospital, and at last all the other members of the

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house were removed to the quarantine hospital, which I used for this purpose on this occasion for the first time. All the patients recovered, and I was on the point of congratulating myself on my success, when a Mrs. Inglis (mother of other patients of that name in the recent attack), residing at the Queen's Buildings, the very house where the recent outbreak took place, was found to be suffering from typhus fever. On inquiry it was discovered that Mrs. Inglis had been employed as a sort of charwoman at the fever hospital, and had washed the floors of the wards occupied by the Daly family. Mrs. Inglis was removed to the fever hospital, and the house disinfected. She returned convalescent from the fever hospital on January 23rd. On February 4th two of her children were found to be suffering from typhus fever; they were removed to the fever hospital, where one of them died. The rest of the family of Inglis were then removed to the quarantine hospital, and also a family named Murphy, who occupied a room in the same house, immediately opposite Mrs. Inglis's room. I did not interfere with a family named Fraser, who occupied the lower rooms of the house. On February 10th Mrs. Fraser had to be removed to the fever hospital, where she died of typhus fever, and four of her children had also to be removed to the fever hospital, suffering from the same disease. The epidemic then died out, and, with the exception of two distinctly imported cases in August of the same year (both of them died), there was not only no case of typhus fever in Inverness from August 1887 to April 1889, but hardly any cases of any infectious disease. The town was free from fever during that time. Then the recent outbreak I have described took place, having the very curious connection with the former epidemic. I am of opinion that the second outbreak began in the room occupied by the Murphy family. For months members of this family were attended by a medical man, who found them suffering from a sort of low fever which could not be well defined. The other affected families were in communication with this family, and so the disease spread, leaving a very suitable soil. The history of these two epidemics, I think, proves the advantage of towns having a quarantine hospital such as I have used, and also the great necessity for taking very rigorous and thorough measures when such an epidemic breaks out, if they are to be of any use. You will observe that throughout both epidemics there runs a connected chain. In every instance affected persons were either in actual contact with or in very close proximity to the disease—in the case of the

sanitary inspector, on one occasion only. The period of incubation appears to vary much; in the case of Mr. MacDonald, Sanitary Inspector, it was six days, while in the case of Jessie Inglis, the disease was developed three weeks after removal from the source of infection.

ANALYSIS OF 118 CASES OF LEPROSY IN THE TARNTARAN ASYLUM (PUNJAB).

REPORTED BY GULAM MUSTAFA, ASSISTANT SURGEON.

BY PHINEAS S. ABRAHAM, M.A., M.D., B.Sc., F.R.C.S.I.

(*Read: January 8th*, 1890)

IN the discussion on my paper on Leprosy, read before this Society in May 1889, it will be remembered that the Rev. E. Guilford, who had lately returned from India, made some interesting remarks upon the disease as he had seen it among the patients at the Tarntaran Leper Asylum (Punjab), of which he had been superintendent for some time. That gentleman then promised to obtain, for the information of the Society, further particulars and histories of the cases. This he has done, and a volume of MS. notes which he wrote for, has been handed to me, through the kindness of our member, Brigade-Surgeon Scriven, M.D.

The notes have been compiled by Mr. Gulam Mustafa, and although incomplete in some respects, they appear to me to be of very great interest, and quite worthy of the consideration of the members of the Society. They consist of short histories of some 120 adult cases, now, or recently, inmates of the asylum; and, on the whole, they illustrate several points of etiological significance. The language may sometimes appear a little quaint—at any rate, to an unimaginative European mind; but, with the exception of a few obvious inaccuracies, particularly in reference to dates, the accounts bear evidence of considerable care and knowledge of the subject on the part of the compiler.

I have tabulated the cases, giving particulars as to sex, age, variety of the disease, its duration, number of relations affected, number of progeny, evidence as to a fish diet, the first symptoms observed, and some other details.

Two of the cases (Nos. 77 and 81) are evidently purely syphilitic, although one, it is stated, "thinks himself a leper"; two are incipient (Nos. 83 and 84); and a third (No. 38) is said by the doctor to have "no symptoms of leprosy on her body, though she pretends to say that she has got the disease".

Of the 118, seventy-five are males and forty-three females (*i.e.*, in the proportion of 1.7 to 1)—a much higher proportion of the latter than we should expect from the census returns of the lepers of India in 1881. Fifty of the inmates are Mussulmans (twenty-six males and twenty-four females); the rest are mostly Hindoos. The highest age recorded is eighty years for two males and one female; the lowest eighteen. The very young lepers, of whom there are evidently several in the asylum, are not included in the Report.

The comparative ages are as follows:

Number of Cases.

Age 18	20 to 29	30 to 39	40 to 49	50 to 59	60 to 69	70 to 80	
Males...1	10	15	12	23	11	3	= 75
Females	4	5	11	5	16	2	= 43
Total...	14	20	23	28	27	5	118

The average age being about forty-eight years.

These ages are manifestly only approximate; it struck me as curious, that of the whole number of cases recorded, only five ages are not put down as multiples of five. I have seen it stated that on the matter of their ages the statements of Indian natives are generally more or less unreliable. The figures above given, therefore, and those relating to the duration of the disease and time of onset, cannot be regarded as absolutely correct.

In sixteen of the cases the symptoms of the disease seem to have appeared in childhood or early youth; in sixty-six between puberty and thirty-five years of age (thirty-six of these being between twenty and thirty years of age); in twenty-one cases the onset has apparently been between the ages of thirty-five and fifty-five; and in two cases the disease manifested itself in old age, one being a woman of seventy, affected only three years; the other a man of eighty, who had been a leper for six years. The mean age of onset in 105 cases is about twenty-two years.

As regards the duration of the disease in the asylum cases—

11	had been affected for	5 years or under	
25	" "	6 to 10 years	
45	" "	11 to 20	"
17	" "	21 to 30	"
4	" "	31 to 40	"
3	" "	41 to 50	"
2	" "	55	"

Average duration for 107 cases = 16.25 years.

Concerning the relative number of cases of the chief varieties of leprosy, the data given are not quite sufficient to arrive at a certain conclusion. As far as can be made out, however, the form of the disease in which the atrophic and anæsthetic symptoms are most marked is represented in seventy-six cases (or 64.4 per cent.), forty-eight being males and twenty-eight females, while the variety characterised by nodular dermal growths is exhibited particularly in fourteen cases, nine males and five females. Twenty-five cases appear to be "mixed", sixteen males and nine females.

These numerical averages may be contrasted with those calculated by various observers in some other parts of India, as in the following table, which is necessarily incomplete:—

	Almora.	Sidlkok.	Rungpur.	Bombay.	Western India.	Madras.	Central Provinces.
Proportion of Males to Females	1.5 to 1	4 to 1	2 to 1	4.38 to 1	3.3 to 1	...	...
Average age of Patients	37.2 yrs.	...	...	30 to 35	30 to 35	32.4	...
Average age of attack	23.7 yrs.	...	...	...	25	26	20 to 25
Average duration at time of observation	13.7 yrs.	...	...	5 to 10	...	6.4	...

Relations affected.—The reporter seems to have made very careful inquiries as to the antecedents and family history of nearly every case in the asylum. In most instances he gives particulars concerning the parents, and the brothers and sisters; their deaths, marriages, and offspring; and often details regarding the uncles and aunts, and other relations. It is quite evident that he is a believer in the heredity of the disease, and that in every case he seeks for this as an etiological factor.

In seventy-one cases it is definitely affirmed that no trace of the disease existed in the locality. Thirty-eight patients—*i.e.*, 32.2 per cent. of the whole number—admit that one or more of their blood relations are, or were, lepers; and four state that the disease was present only in distant relations. In five instances, connections by marriage alone were affected. Both parents were diseased in three cases; the father in twelve; the mother in five; a grandmother in one; uncles in eight; brothers in eleven; sisters in four; "mothers'" relations in three; cousins in three; other distant relations in one; sons

(first affected) in three; husbands in two; husbands' relations in four; an uncle's wife in one.

In some cases several of the relatives were leprous; *e.g.*, in case 108, as many as fourteen.

Progeny of the Lepers.—Seventy-three of the total number appear to have been married before the onset of the disease, viz., forty-three males and thirty females; and whilst still in the healthy condition, the males are credited with seventy-one children, now or lately living, and in most cases free from the disease, and the females with sixty-five; total, 136. Four only, all females, are stated to have given birth to offspring, five in all, after the disease had declared itself.

Until recently, it was the custom in this asylum to allow the patients to intermarry. Thirty-nine of those whose histories are here recorded—viz., sixteen males and twenty-three females—availed themselves of the privilege, and some of them married more than once; thus, one man united himself with no less than five leper wives one after the other, and several other patients were married two or three times. Altogether, the number of marriages contracted by the men in the list amounts to twenty-six, and those of the females to twenty-nine. Only five of the men proved prolific, with a result of ten children, and eight of the women with a result of fifteen children. Four of the children are dead, so that we have left twenty-one as the progeny of fifty-five marriages. As the notes give no information as to the names of the leper or lepers which each man or woman married, it is impossible to say whether the children and the marriages are not counted twice in the above calculation. It is probable that the actual sterility is even greater than these figures indicate.

The desire for matrimony does not seem, however, to be quite universal among the inmates of the asylum, for we read of one woman who "did not marry with any lepers, though she was excited by lepers to marry".

Particulars as to a Fish Diet.—The reporter seems to have had his mind open as to the possibility of a fish diet being a cause for leprosy; for in the majority of the cases he specifically alludes to the former habits of the patients in this respect. In thirty-one instances he makes some such remark as this: "Never tasted fish in his life;" five of the patients are stated to have "seldom" or "rarely" partaken of fish; forty-two to have "sometimes" eaten it; and only four of the 118 to have indulged in a fish diet "in excess" or "in plenty", or "often". In thirty-six of the histories fish is not alluded to, but in several of these the words "no special diet"

occur, and there is reason to believe that by this expression it is meant that fish was not eaten. In others, again, it is simply stated that the patient lived on the usual food of his class—" dal, bread, vegetables, etc."

First Symptoms Observed.—The attention of the patients seems to have been first directed to their malady by the occurrence of a "whitish eruption" in forty-seven cases, "blisters" on the joints in twenty-three, a reddish eruption in ten, swelling of the face, hands, etc., in nine, and weakness and anæsthesia of hands and feet in eight. A sensation of heat in the skin, general weakness, fissures on the soles of the feet and toes, a pricking sensation in the throat, and the atrophy of a digit, are variously put down as the first symptoms observed in other cases. Prodromates, if any, appear to have been for the most part overlooked, but previous attacks of fever are mentioned in a few cases. Some three or four of the patients ascribe the origin of their complaint to some traumatic injury, such as a snake-bite; and one man is said to have been pricked on the buttock by a pointed piece of stone, the part inflamed, a large ulcer remained, not healing for four years, and leaving an anæsthetic surface.

In nineteen cases it is reported that chaulmoogra and gurjun oils have been used, but only in two is there stated to have been any benefit. Few or no details are given as to the persistency or thoroughness of their application. With reference to one of the successful cases (No. 98), we are told, "She is taking chaulmoogra oil from Oct. 1877; she says she is stronger than before; the disease is stopped in future"; but in the corner of the page is to be seen the ominous word, "Died", no doubt subsequently written. As an etiological factor, the reporter seems to attach some importance to the existence of syphilitic taint, for he has evidently inquired into the matter in nearly every case. Of one case (No. 71) he writes, "There is history of syphilis in his family and in him, which easily describe the cause of the disease." He could find evidence of syphilis only in four others.

In one case (43), "the disease has subsided since twenty years"; and in three others it is said to have stopped its course. In some eight cases it is stated that only the extremities are or have been affected. (I mention this because, in the case of a patient shown at this Society last May, some doubt was expressed as to whether he was really a leper, partly, I believe, on the ground that it was supposed that there were no very obvious symptoms of the disease on other parts of the man's body besides the extremities.)

Although it cannot be said that we learn very much that is novel with regard to leprosy from these notes, the facts detailed should be useful in corroborating, or otherwise, the information obtained by observers in other parts of India and elsewhere. I should have liked, indeed, on this occasion, to contrast, in a comprehensive way, these details with the similar data of the various other asylums of India, but unfortunately the reports available are so few and incomplete (with one or two exceptions, notably the excellent account of the Almora Asylum by Drs. Lewis and Cunningham in 1876), and compiled so many years ago (chiefly 1874-77), that not many general conclusions of value up to date could be arrived at. There can be no doubt that our knowledge of the disease would be greatly enhanced if full and systematic reports of every asylum were annually, or at definite intervals, published on a uniform plan. The present lack of reliable data well illustrates the need of a thorough and systematic investigation, such as is likely to be shortly set in motion through the initiation and support of the Damien Committee and of the Colleges.

Case No.	Name.	Sex.	Caste.	Age.	Variety of Disease.	Duration of Disease.	Relations Affected.
1	Gaza ...	m.	Hindoo jat...	32	Mixed ...	10 years	None ... ...
2	Ohdo ...	m.	Brahmin ...	30	Do. ...	5 „	None ... ...
3	Ram Tall ..	m.	Ditto ...	30	Anæsthetic, ? mixed	10 „	Father ...
4	Bannan ...	m.	Ditto ...	18	Anæsthetic	7 „	Mother and an uncle
5	Sardanis ...	m.	Hindoo ...	47	Do.	?	None ... ...
6	Chhaboo ...	m.	Ditto ...	22	Do.	3 „	Father and 3 brothers
7	Mihal Das ...	m.	Chamar ...	55	Do.	7 „	None ... ...
8	Boola ...	m.	Mussulman	25	Mixed	7 „	None ... ...
9	Natho ...	m.	Ditto	25	Do.	10 „	Mother ... ...
10	Shadee ...	m.	Sweeper ...	35	Anæsthetic	12 „	Maternal relatives ...
11	Jamala ...	m.	Hindoo ...	30	Do.	6 „	Father ... ...
12	Makhan ...	m.	Mussulman	50	Do.	12 „	None ... ...
13	Bolund Shah	m.	Ditto	50	Mixed ...	? 20 „	None ... ...
14	Khewan ...	m.	Ditto	25	Tuberc. ...	5 „	None ... ...
15	Gurdetta ...	m.	Chamar ...	30	Anæsthetic	? 5 „	Maternal uncle ...
15a	Bariptoo ...	m.	Jheur ...	25	Do.	7 „	None ... ...
16	Bhairon ...	m.	Kohle ...	50	Do.	20 „	None ... ...
17	Sodaga ..	m.	Brahmin ...	50	Do.	20 „	None ... ...
18	Hera ...	m.	Hindoo ...	60	Do.	7 „	None ... ...
19	Jawala Singh	m.	Jat ...	35	Do.	15 „	None ... ...
20	Jaute ...	f.	Mussulman	60	Do.	50 „	None ... ...
21	Hari Singh ...	m.	Jat ...	60	Do.	20 „	None ... ...
22	Nabya ...	m.	Rajpoot ...	50	Do.	25 „	None ... ...
23	Dani ...	f.	Mussulman	80	Tuberc. ...	55 „	Husband was affected; none of other relations
24	Gansee ...	f.	Ditto ...	60	Anæsthetic	30 „	None; 6 children were affected
25	Nathoo ...	m.	Jat ...	50	Do.	30 „	None ... ...
26	Ghasita ...	m.	Chamar ...	40	Do.	28 „	Mother ... ...

No. of Children.	How Commenced.	Fish Diet.	REMARKS.
Not mar.	Bullæ on legs and arms	Never	
Not mar.	Whitish patches on body and extremities	Never	
Not mar.	Whitish patch on thigh	Never ...	History of Syphilis.
None	Ditto	Never	
2 (youngest 12) ...	Whitish patches on body	?	
None	Numb spots on thigh ...	?	
Not mar.	Ditto	?	
Not mar.	Whitish spots on body, etc.	?	
Mar. ? none	Whitish spots on back and buttock	Sometimes	
1 son (died at 1 year) ...	Blisters on fingers and feet	Seldom ...	Rest of body quite healthy; only hands and feet affected.
None	Anæsth. of leg ...	?	
	Numb patches on thigh	None	
Was mar.; 1 child died at 2 years	Queer sensation of heat and had anæsthesic patches on body	? ...	Wife free from disease.
2 sons, 20 years ...	Weakness in limbs and afterwards redness and swollen face	Sometimes	Had syphilis.
1 son and 1 daughter (born when he was healthy)			
Was married and had 3 children	Numbness of right foot	Sometimes	Syphilis 15 years ago; only hands and feet affected.
Not mar.	Whitish spots on body	Sometimes	Derived benefit from chaulmoogra oil.
Not mar.	Anæsth. of right hand (fingers)	Sometimes	Extremities only affected, and eyes, and some teeth dropped out (ascribes it to taking milk and fish together).
Mar. a leper (? no children)	Anæsth. of right index finger	Sometimes	
Was mar.; 4 children ...	A fissure at root of right great toe	Rarely	
Mar. twice; had children, but died	Whitish erupt. on left arm	Sometimes	
Not mar.	Red erupt. like tertian over body	? ...	No ulceration or loss of sight; praises oil of Tara meera.
Was mar.; no children ...	Reddish erupt. over body and swelling of face	Never	
Mar. a leper; no children	Whitish patch on back	Never	
2 daughters before she was affected; one was leprous	Tubercles on chest ...	Seldom ...	There is now anæsthesia of extremities.
6 children born before she was affected, healthy	Pricking on thumb ...	? ...	Was told she was bitten by a snake.
Not mar.	Blisters in joints of fingers	? ...	Has tried chaulmoogra and gurjun.
2 daughters and 1 son who is becoming leprous	Red erupt. on back, and blisters in joints	? ...	Has children by a leper woman born in the Asylum.

Case No.	Name.	Sex.	Caste.	Age.	Variety of Disease.	Duration of Disease.	Relations Affected.
27	Bhagan ...	f.	Mussulman	60	Anæsthetic	20 years	None ... ...
28	Rabdi ...	f.	Hindoo ...	40	Do.	33 „	? ... ...
29	Bhagan ...	f.	Mussulman	60	Do.	35 „	None ... ...
30	Sultani ...	m.	Jat ...	40	Do.	14 „	One half-brother ...
31	Rulya ...	m.	Musician (beggar)	25	Do.	20 „	Father and mother, both died in Asylum
32	Sundari ...	f.	Chamar ...	40	Do.	28 „	Father and a cousin
33	Panon ...	f.	Jat ...	30	Do.	12 „	2 brothers ...
34	Gayanon ...	f.	Chamar ...	60	Do. ? mixed	25 „	None ... ...
35	Jeemee ...	f.	Sweeper ...	60	Anæsthetic	After birth of the children	None ... ...
36	Maula ...	m.	Mussulman	50	Do.	?	None ... ...
37	Rajee ...	f.	Do. potter	25	Do.	18 years	None ... ...
38	Budhee ...	f.	Do. Teli	25	No symptom of the disease	Has been in the Asylum since 12 years old	Both parents died of the disease
39	Sulheta ...	m.	Hindoo ...	50	Anæsthetic	17 years	None ... ...
40	Chetoo ...	m.	Mussulman, water-bearer	65	Do.	40 „	None ... ...
41	Amira ...	m.	Hindoo Sien	55	Do.	25 „	2 younger brothers ...
42	Gangee ...	f.	Bahte ...	60	Mixed ...	16 „	None ... ...
43	Tachmer ...	f.	Sweeper ...	60	Anæsthetic	From childhood	Father and 1 brother
44	Rajan ...	f.	Mussulman	50	Do.	18 years	Paternal uncle ...
45	Varyam ...	m.	Do. potter	60	Do.	12 „	Father ... ...
46	Mam Din ...	m.	Mussulman	30	Do.	10 „	Maternal relation ...

No. of Children.	How Commenced.	Fish Diet.	REMARKS.
9 children born before and 2 after she became leprous; none affected	Atrophy of little finger	Never ...	After entering Asylum, married a leper
4 children, 2 lepers; three of them with symptoms	Erupt. on body and blisters on fingers, etc.	?	
Mar. before she was affected; 3 children. Mar. a leper in Asylum; no children	Pain in right side of chest.	Often	
2 sons and 1 daughter before he was affected	Whitish erupt. on thigh	Sometimes	Has tried chaulmoogra and gurjun.
2 children, 1 a leper; 1 died	Erupt. on body ..	? ...	Has tried chaulmoogra and gurjun.
4 children, 3 lepers; 1 died	Ditto	?	
Mar. to a leper for 10 yrs.; no children	Blisters on body ...	?	
8 children before she was affected, and 1 shortly after she married a leper; no issue	Face red and swollen and blisters on joints	?	
9 children before disease appeared. Mar. in Asylum 2 lepers; no children	Burning sensation of body and whitish erupt.	?	
Mar. 3 lepers, by one 3 children; 1 died	Erupt. on body ...	?	
2 children by a leper; 1 died	Ditto	Sometimes	
Mar. a leper and has 3 children	... ...	?	
Was mar.; 1 son and a daughter 3 years old; both healthy. Mar. a leper; have no children	Swelling and redness of whole body	Sometimes	
Mar. 2 or 3 lepers; have no children	Anæsth. of left hand and foot	? ...	Thinks himself a born leper because fingers of left hand are contracted on palm at birth.
Was mar.; 3 children and full grown and healthy	Whitish patch on forearm	Sometimes	
Was mar.; 2 children, 1 girl now 10 years, born after she was affected, and now with incipient leprosy	Blister on ankle ...	? ...	
Mar.; no children ..	... ...	? ...	Father was buried alive "on account of the suffering". The disease has subsided since 20 years.
Was mar.; 5 children before she was affected. Mar. a leper; no children	Red and swollen face, then vesicle in joints	Sometimes	
?	Fever	Never ...	
Mar. 5 lepers; no children	Whitish erupt. on body	Sometimes	

Case No.	Name.	Sex.	Caste.	Age.	Variety of Disease.	Duration of Disease.	Relations Affected.
47	Bahadur ...	m.	Sweeper ...	60	Anæsthetic, ? mixed	15 years	None ... ...
48	Chanda Singh	m.	Jat ...	50	Anæsthetic, ? mixed	30 „	None ... ...
49	Geewa ...	m.	Mussulman	50	Anæsthetic	17 „	Maternal grandmother
50	Mohamada ...	m.	Ditto	35	Do.	10 „	None ... ...
51	Jamita ...	m.	Ditto ...	60	Do.	18 „	None ... ...
52	Mangtoo ...	m.	Hindoo ...	50	Do.	12 „	None ... ...
53	Jawahar ...	m.	Chamar ...	50	Do.	18 „	None ... ...
54	Choohar ...	m.	Ditto ...	50	Do.	18 „	An uncle's wife ...
55	Kesi ...	f.	Ditto ...	60	Do.	50 „	None ... ...
56	Jewani ...	f.	Mussulman	40	Do.	28 „	The husband's family
57	Manon ...	f.	Sweeper ...	30	Tuberc. ...	9 „	2 uncles ... ...
58	Ilahi Bakhish	m.	Mussulm. jat	20	Do.	14 „	Father, uncle, and step-uncle
59	Bahto ...	f.	Brahmin ...	50	Anæsthetic	25 „	Mother - in - law's family
60	Pargash ...	m.	Hindoo ...	40	Do.	30 „	None ... ...
61	Jewan ...	m.	Mussulman	60	Do.	16 „	A brother ...
62	Bira ...	m.	Ditto	60	Do. ? mixed	12 „	None ... ...
63	Budhuo ...	m.	Ditto	55	Anæsthetic	21 „	Maternal uncle's son
64	Dauli ...	f.	Ditto	35	Do. ? mixed	20 „	None ... ...
65	Manon ...	f.	Ditto	35	Anæsthetic	20 „	An uncle ...
66	Punnoon ...	m.	Ditto	50	Do.	16 „	None ... ...

No. of Children.	How Commenced.	Fish Diet.	REMARKS.
Was mar.; 4 children ...	Red and swollen hands	Sometimes	
Mar. a leper; no children	Front of knee ...	Never ...	
2 children by a leper; 1 died	Whitish patch on joints. After "anæmia"	Sometimes	
Was mar.; no children. Mar. a leper; no children	Blister on finger ...	Sometimes	Only extremities affected; rest of body healthy. "The disease is stopped."
Was mar., and had 4 children	Anæsth. patches on breast and thigh	Sometimes	The disease has stopped its course.
Was mar.; 5 children ...	Blister on ankle ...	Sometimes	"No eruption of any kind on the body."
Was mar.; 6 children. Mar. 2 lepers; no children	Blister on elbow ...	Sometimes	
Was mar.; 3 children. Mar. a leper; 1 daughter with incipient symptoms	Blister on joints ...	Sometimes	"No sort of eruption on any part of the body" (but general anæsthesia).
Mar. a leper; no children	Blisters on legs and feet	Sometimes	Extremities only affected.
Was mar.; 2 children, 1 died. Mar. 2 lepers; now pregnant	Whitish erupt. on forearm	Sometimes	
Was mar.; 1 son born before disease commenced, but suckled aferwards	Red and swollen face ...	? ...	Derives benefit from "Mundi Booti".
Not mar.	Blisters on hands and feet	?	
None	Burning heat—head, hands, and feet	None ...	"Did not marry with any leper, though she was excited by lepers to marry. No eruption on any part of the body."
Was mar.; none ...	Whitish erupt. on leg ..	Sometimes	Treated with gurjun oil without benefit.
Was mar.; none, and mar. a leper; no issue	Blisters on fingers and feet	Sometimes	
... ...	Blisters and swelling after snake bite	Never	
Was mar.; 2 children. Mar. again at Asylum; no issue	Pains in legs after a chill	Sometimes	
Mar. 2 lepers... ...	Whitish erupt. of body	Sometimes	
Mar. a leper; no issue ...	Whitish erupt. on body	Never	
Mar. a leper; 2 sons ...	Whitish erupt. on ankle after a chill	Sometimes	

Case No.	Name.	Sex.	Caste.	Age.	Variety of Disease.	Duration of Disease.	Relations Affected.
65a	Dittesha ...	m.	Mussulman	70	Anæsthetic ? mixed	55 years	None ... ...
66a	Bhagan ...	f.	Ditto	45	Anæsthetic	18 „	Father, a sister ...
67	Walate ...	f.	Ditto	60	Do.	10 „	None ... ...
68	Rehmal ...	m.	Ditto	45?	Do.	30 „ (at 12 yrs.)	None ... ...
69	Karem hibi ..	f.	Ditto	45	Do.	? since youth	None ... ...
70	Gokal ...	m.	Hindoo ...	50	Do.	10 years	None ... ...
71	Jassa ...	m.	Brahmin ...	40	Do. ? mixed	10 „	None ... ...
72	Dana ...	m.	Hindoo ...	50	Anæsthetic	10 „	None ... ...
73	Ushnag ...	m.	Ditto ...	32	Do. ? mixed	18 „	None ... ...
74	Baldeo ...	m.	Ditto ...	50	Anæsthetic	1 „	A maternal uncle ...
75	Ganga Ram...	m.	Brahmin ...	50	Do.	18 „	In distant relatives
76	Dayala	m.	Hindoo ...	50	Tuberc., ? mixed	27 „	Father and 1 brother
77	...	...	...	...	...	...	... ...
78	Reora ...	m.	Sweeper ...	30	Anæsthetic	3 „	None ... ...
79	Kahan Singh.	m.	Hindoo ...	60	Tuberc.	5 „	None ... ...
80	Chatoo ...	m.	Brahmin ...	50	Anæsthetic	10 „	None ... ...
81	...	...	...	...	...	...	... ...
82	Jeeta ...	m.	Sweeper ...	40	Mixed ...	10 „	None ... ...
83	Jhandno ...	m.	Chamar ...	25	? incipient	2 „	Paternal uncle ...
84	Rukko ...	f.	Sweeper ...	20	Incipient...	?	Mother and 2 brothers
85	Shamas Din ..	m.	Mussulman	45	Tuberc. ...	10 „	None ... ...
86	Sharif Khan ..	m.	Ditto	60	Mixed ...	?	None ... ...
87	Umra ...	m.	Ditto	25	Tuberc., ? mixed	12 „	None ... ...

No. of Children.	How Commenced.	Fish Diet.	REMARKS.
Was mar.; 1 daughter, and mar. a leper; no issue	Anæsth. patches ..	Sometimes	
Was mar.; 3 children, and mar. a leper; 2 sons	Whitish patches ...	Never	
Was mar.; 6 children. Mar. a leper; no issue	Reddish patches on buttock	Never	
Mar. a leper who had a child	Whitish erupt. on body	Very often	
Was mar.; 3 children, youngest 14 years old with incipient leprosy	Ditto	Sometimes	
Was mar.; 3 children ...	Ditto	Never	
Was mar.; 1 daughter ...	"Œdema" of left leg ...	Never ...	"There is history of syphilis in his family and in him, which easily describe the cause of the disease."
Was mar.; no children ...	Sensation of heat in the body	None	
Was mar.; 1 daughter died	Itching and watery pimples over body	? ...	Syphilis in the family.
... ...	Hands became weak and anæsth. grad. to elbows and knees	Sometimes	
Was mar.; 3 children ...	A pointed stone pricked his buttock, causing ulcer, healing after 4 years with anæsth. surface	Sometimes	Ulcers only on extremities. "No history of whitish erupt. on body."
... ...	Anæsth. patch on knee	Never	
... ... Was mar.; 2 sons, youngest 6 years.	... ... Whitish erupt. on body	... ?	This is a pure case of syphilis.
Was mar.; 3 sons ...	Red erupt. on body ...	Never ...	Takes chaulmoogra (produces nausea) and gurjun.
Was mar.; 3 sons ...	Loss of sensation in leg after fracture of patella	Never	
... ... Was mar.; no children ...	.. ... Whitish erupt. on body	... ?	No symptoms of leprosy, but thinks himself a leper.
Was mar.; no children ...	Gen. weakness. Swelling and redness of feet and hands	? ...	No marked symptoms of leprosy; chiefly suffers from weakness of extremities.
Mar. a leper; no children	Large anæsth. whitish patch on buttocks and thighs	?	
Was mar.; 2 children ...	Whitish patches on arms and hands	?* ...	Died from dysentery after three years in Asylum.
Was mar.; 4 children ...	Attack of fever followed by insensibility of hands and feet	"In excess"	Chaulmoogra and gurjun without relief.
Mar.; 2 children ...	Blisters on feet after a chill	Never ...	Chaulmoogra and gurjun without effect.

Case No.	Name.	Sex.	Caste.	Age.	Variety of Disease.	Duration of Disease.	Relations Affected.
88	Tahee ...	f.	Mussulman	50	Anæsthetic, ? mixed	10 years	In father - in - law's family
89	Sin Dhor ...	m.	Hindoo ...	35	Tuberc., ? mixed	15 „	1 cousin ... ...
90	Imam Din ...	m.	Mussulman	35	Anæsthetic	3 „	None ... ...
91	Budh Das ...	m.	Hindoo ...	25	Tuberc. ...	5 „	None ... ...
92	Bhumba I. ...	m.	Mussulman	80	Anæsthetic	6 „	None ... ...
93	Bhumba II....	m.	Ditto	30	Tuberc.	7 „	None ... ...
94	Nanakoo ...	m.	Hindoo ...	35	Anæsthetic	14 „	None ... ...
95	Chumbo ...	f.	Ditto ...	40	Do. ? mixed	22 „	An elder sister ...
96	Tara Singh ...	m.	Ditto ...	60	Anæsthetic	10 „	None ... ...
97	Rali ...	f.	Ditto ...	30	Muscular, ? tuberc.	Since very young	Father and 5 uncles
98	Ramee ...	f.	Ditto ...	35	? mixed ...	15 years	None ... ...
99	Dayan ...	f.	Ditto ...	45	Anæsthetic	12 „	None ... ...
100	Tikho ...	m.	Ditto ...	45	Do.	15 „	In mother's relations
101	Jawalee ...	f.	Ditto ...	40	? mixed ...	15 „	Husband's uncle and aunt
102	Matte ...	f.	Ditto ...	60	Anæsthetic	35 „	A son first affected; no other relation
103	Bahto ...	f.	Ditto ...	60	Tuberc. ...	10 „	A member of the same caste, but not closely related, and a son
104	Bhagan ...	f.	Ditto ...	60	Anæsthetic	20 „	Mother ... ...
105	Bisnandai ...	f.	Brahmin ...	50	Do.	17 „	None ... ...
106	Budhoo ...	m.	Hindoo ...	80	? mixed ...	? 45 „	None ... ...
107	Amseree ...	f.	Mussulman	40	Anæsthetic	12 „	Father, 2 sisters, and 1 brother
108	Mannan ...	f.	? ...	60	Do.	30 „	Both parents, 3 brothers, 1 sister, 1 son, uncles, etc.
109	Mamoon ...	m.	Mussulman	40	Do.	8 „	None ... ...

No. of Children.	How Commenced.	Fish Diet.	REMARKS.
Was mar.; 6 children ...	Whitish erupt. after fever	?*	
Was mar.; 1 son 7 years old	Fissures on soles of feet, epistaxis, and patch on forearm	?*	
Was mar.; 2 children, died	Patches on back ...	? ...	Chaulmoogra and gurjun; no effect.
... ...	Whitish erupt. on body	?* ...	Chaulmoogra and gurjun; no effect. Died of phthisis.
Was mar.; 3 sons ...	Numbness of hands ...	Sometimes	Chaulmoogra and gurjun; no effect.
Was mar.; had children, all died	Pricking sensation over body	None ...	Ditto.
Was mar.; 2 daughters...	Blister on little finger	Sometimes	Died from phthisis.
Was mar.; no children. Mar. a leper; no children	Whitish erupt. on thigh	Rarely	
Was mar.; 6 children ...	Reddish erupt. on body, and subsequently bullæ	Never	
Was mar.; and with a leper	Whitish erupt. on body	Never	
Was mar.; 1 son of 15 ...	Reddish erupt. ...	Never ...	"She is taking chaulmoogra oil from Oct. 1887. She says she is stronger than before; the disease is stopped in future. Died."
Was mar.; 4 children grown up, and mar. a leper	Weakness of hands ...	Never ...	
... ...	Whitish erupt. in abdomen	?* ...	Vegetable diet and milk.
... ...	Pimples on nose, and red erupt. on forehead	Sometimes	
Was mar.; 1 son ...	Whitish erupt. on shoulder	Sometimes	
Was mar.; 11 children ...	Redness and swelling of face	Rarely ...	Husband had syphilis. Her third son first became affected; she lived with him, and was diseased 2 years after his death.
Was mar.; 2 children ...	Whitish erupt. on body	? ...	Her mother *æt.* 80, still in Asylum.
Was mar.; 2 sons ...	Swelling of hands and feet	Sometimes	
... ...	Œdema of whole body...	Sometimes	"The disease has abated in him." Lived in the Asylum 25 years.
Was mar.; 4 children ...	Whitish erupt. on arms and legs	Sometimes	
Was mar.; 2 daughters, 1 living, 1 son died of leprosy	Whitish erupt. on forearm	Never	
... ...	Whitish erupt. on ankle	Sometimes	Only extremities affected.

Case No.	Name.	Sex.	Caste.	Age	Variety of Disease.	Duration of Disease.	Relations Affected.
110	Bihee ...	f.	Mussulman	70	Anæsthetic	3 years	6 maternal relations, husband, and son
111	Chundee ...	f.	Sweeper ..	25?	Do.	10 „	No history ...
112	Karmbhari ...	f.	Mussulman	40	Do.	20 „	2 brothers ...
113	Mohamad Bakhsh	m.	Ditto ...	40	? mixed ...	30 „	None ... ...
114	Mihra ...	m.	Ditto ...	40	Mixed ...	20 „	Father ... ...
115	Bibo ...	f.	Ditto ...	60	? mixed ...	12 „	None ... ...
116	Kariman ...	f.	Ditto ...	60	Tuberc. ...	20 „	None ... ...
117	Bannon ...	f.	Ditto ...	45	Mixed ...	12 „	A brother and a son
118							

No. of Children.	How Commenced.	Fish Diet.	REMARKS.
Was mar.; 1 son now a leper. Her husband 5 years ago died of leprosy, son then affected	Blister on joints, leaving ulcers	Sometimes	
Mar. a leper; no children	Whitish erupt. on body	?	
Mar. 2 lepers... ...	Ditto	Sometimes	
Mar. a leper	Epistaxis and blisters on joints	Plenty	
... ...	Whitish patch on thigh	Sometimes	His father bitten by a snake.
Was mar.; 3 children, all healthy. Mar. a leper; no children	Fever and red swollen face	Never	
Was mar.; no children. Mar. 2 lepers	Red elevated erupt. over body	Never	
Was mar.; 1 son, died young. Mar. a leper; 1 son 12, 1 daughter 5 years old	Blisters on joints ...	Never	

ON THE ARREST AND CURE OF LEPROSY BY THE EXTERNAL AND INTERNAL USE OF THE GURJUN AND CHAULMOOGRA OILS.

By the HON. J. C. PHILLIPPO, M.D., OF JAMAICA.

WITH INTRODUCTORY REMARKS, AND ABSTRACT OF PATIENT'S ACCOUNT,

By P. S. ABRAHAM, M.A., M.D., B.Sc., F.R.C.S.I.

(*Read: January 8th*, 1890).

Dr. Phillippo has requested me to bring this case under the notice of the Epidemiological Society. It is hardly necessary for me to allude to that gentleman's high position as one of the chief medical practitioners in the West Indies, and to his extensive experience of the endemic diseases of that part of the world; but I may mention that so long ago as 1873 he was quoted by Dr. Gavin Milroy* as an authority on this very disease. His observations, therefore, must be regarded as of especial value, and his conclusions received with attentive consideration by all who are interested in the subject of leprosy.

In a private letter to me, Dr. Phillippo calls the case "a unique one—for it is written by the patient himself"; and I think it will be admitted that a more graphic and well-written account, both as regards expression and calligraphy, has seldom been penned by a non-medical convalescent, and never before by one who is a cured leper. As the notes are rather detailed, I append an abstract.

The young man's father was an Englishman, long resident in Jamaica, whom I happen to have known, as well as several other members of the family, on the paternal side, both in England and in Jamaica. They are all healthy people, and, as far as one can on such a point, I can testify to their freedom from any trace of the disease. The mother, a creole, is, according to Dr. Phillippo, "a very fair woman, whose mother, grandmother, and other relations" he knows, "and there has never been any disease of the kind in them." It will be difficult, therefore, for those who believe in the heredity of leprosy to assign family taint as the cause in this instance.

The appearances in the case were evidently typical of the

* Report on Leprosy in the West Indies.

"nodular dermal" or "hypertrophic" form of the disease; and one point of interest to me is the apparent connection between the initial traumatic lesion and the onset of the symptoms. In looking over reports of cases occurring in various parts of the world, we find several instances in which accidental wounds of the skin are described as refusing to heal, ulcerating, etc., and in a shorter or longer time the signs of leprosy becoming manifest.

With regard to the treatment, one is struck by the thoroughness and perseverance with which it was carried out. As the patient remarks, for some five and a half years he practically lived "in grease". How many lepers are there who have so pertinaciously continued to use such irksome remedial measures, and how many of their physicians and friends would not have given up hope in a year or two at the utmost? Dr. Phillippo's remarks on the difficulty of following up a treatment of this kind in private practice deserve attention; as a rule, it must be only in properly appointed special hospitals and asylums that the necessary conditions can possibly obtain. A lengthened disquisition on the treatment of leprosy would hardly be in place in this Society; but I may be allowed to observe that there is reason to think, on perusing the conflicting accounts, that many of the reported failures with the gurjun and chaulmoogra oils may be due to their improper and insufficient use, both as regards time and quantity.

Dr. Phillippo writes as follows:—

"Leprosy has been so much and so thoroughly discussed of late that there remains little to be said on the subject, and my only excuse for prolonging the discussion lies in the fact that I have something to say as to its arrest and cure. Before doing so, however, I must state, as one who has had considerable practical acquaintance with the disease, that I am thoroughly opposed to the fish-diet theory. I know numbers of people who have eaten fish almost daily for many years who have shown no symptoms of this disease. The peasantry of this country are, as a rule, practically vegetarians, their principal animal food, but in very sparing quantity, being salted mackerel, shad, and cod, imported from Halifax, which sometimes reaches them in a state of decay, and yet leprosy in proportion to number is much less common amongst them than among other classes who are in a better position in life, and able to afford a more mixed and generous diet.

"Moreover, this disease generally makes its first appearance amongst adolescents, who have not gone through so long a

period of fish eating as others who show no symptom of the disease.

"It is true that more leprosy is to be seen in this as in most other countries on the sea-coast, but this is, I think, largely due to the fact that the poorer class of sufferers flock to the cities and towns, which are generally there situated, for the sake of the charity to be obtained in these larger centres of population.

"That it is both hereditary and contagious I firmly believe, but it never affects a whole family, and will sometimes skip a whole generation. The contagion is by no means active, for the healthy members may be in daily intercourse with the diseased, without contracting it; only occasionally does it happen that one or more take it, and these may, perhaps, have less to do with the diseased member than the others. I know of a family in which two sons had the disease and died of it, and another had incipient symptoms arrested by gurjun oil; the other members in daily attendance had shown no symptoms, whilst the wife of one who belongs to a perfectly healthy family, and who only occasionally came in contact with them, has now ulnar nerve paralysis, with shrinking of the interossei and anæsthetic patches. This and other instances of a similar kind lead me to believe that there must be some constitutional predisposition—I should say of a strumous character. This view I took years ago in my replies to Gavin Milroy's questions on the subject, mentioning the case of an English family resident here of a strumous constitution, in which an uncle developed the disease, and died years before his niece, who was not born at the time, also developed it.

"The treatment of the disease is, however, my subject on this occasion, and I shall now proceed with a short account, which will, I hope, be of interest.

"Gurjun oil was first brought to my notice some twenty years ago in a paper published in the *Edinburgh Medical Journal*, by the surgeon in charge of the penal establishment in the Andaman Islands. At that very time a case came under my observation of a lad who belonged to a family with considerable hereditary history of the disease. The initial sympton was a deep punched-out ulcer at the bottom of one foot, looking like a perforating ulcer, and insensible to pain —a very common commencement of tubercular leprosy. Not being able to get any gurjun oil in England, I sent to Singapore for some, and made use of it, but with very small success, as I left the district shortly after, and could not follow up the treatment.

"In private practice it is difficult to follow up a treatment of this kind. The patients are generally young, careless, and insensible of the terrible malady under which they suffer. The relatives are afraid to make use of direct applications themselves, servants and nurses soon grow weary of a long-continued and apparently useless treatment, and all are ready to give it up for any new remedy or nostrum suggested by sympathising friends.

"Still, in this case, as in some dozen or more others which came under my observation during the last fifteen years, it did good. Ulcers were almost invariably and rapidly cured by its application, and I have been frequently applied to for it on that account. Indeed, I almost look on it as a proof of the correctness of the diagnosis in an early case, though I daresay it may be useful for other ulcers.

"After using the gurjun on these cases under these circumstances I began to despair of ever doing any good, or, rather, seeing any cure as a result, when the following case came under my notice. On taking charge of him I told him that I would only do so on condition that he would under all circumstances stick to my prescription, and take no other advice—that the remedy had been used with good effect, and that he must resist all importunities to change it. This he religiously did, heroically aided by his mother, with the result recorded by himself. He is restored to health, and the mother not only has the gratification of seeing and aiding in this, but has doubtless been saved from taking the disease by the constant use that she made of the remedy.

"As I said before, I was so dispirited with former failures that I took no notes, but this case presents several points of interest, in addition to its successful termination.

"I. The long period that elapsed from the first appearance of the sores, and the constitutional effects. When I first, and casually, saw him, in 1874, he was under no treatment, and I recommended the amputation of the toe, which led to his father placing him under the care of his medical adviser. Had it been amputated then, years of suffering might have perhaps been spared him.

"II. The sudden change after the administration of chaulmoogra. Too sudden for that medicine to have had any effect—yet how likely to have secured for it all the credit.

"III. The complete immunity of the mother, who lived, ate, and drank with him, and dressed his sores day after day, and washed his clothing."

The following abstract of the case is compiled from the patient's own notes and observations.

In the early part of 1872, while bathing in the sea, the great toe of the left foot was injured. The cut remained open, and was treated with some lotion which a school-mate had been using for a bruise. It did not heal for two or three months, during which a boot could not be worn. About six months afterwards the same toe became swollen and black, and the cut reopened. Poultices and lotions were applied, and ultimately the toe got better, but minus the nail. The cut, however, continued to give trouble—opening about once every six months, but always yielding to treatment. Sometime in 1874 it was noticed that there was a scaly appearance round the ankle, and the cut which had opened again was very stubborn. In January 1875, it reopened, and the scaly band round the ankle was then broader. Cashew-nut oil was applied with benefit. Towards the end of 1875 it again reopened; and subsequently generally remained so. In 1876, it was noticed that the hands were not the natural size, and the hairs on the left leg seemed to be withering. Towards the end of 1877 the left ear appeared a little enlarged, and the scaly band around the ankle seemed to be slowly creeping up the leg. In February 1878 the general health had become so bad, that change and rest for a month in the mountains was advised; but no good resulted. The day after the ride home, the face appeared puffed and spotted. From this time, the toe would not yield to treatment, the general health became worse, and fever began to add to the patient's troubles, and he became unable to walk. At this time, early in 1879, the great toe, on which the ulceration had much increased, was so enlarged that it spread over the second toe, upon which there was also an ulcer, with the loss of the nail. The left foot had swollen to a very large size, and it had lost all feeling. The right foot was also a little swollen, the hands very much so, and on two or three of the fingers were small ulcers: one nail was already gone. The ears were much enlarged, particularly the left one; the nose and lips were swollen, and on the nose and upper-lip were pimples, which would not discharge, but remained hard. The forehead was swollen, and the face altogether much disfigured. Spots, too, began to appear on several parts of the body. He moved about with great difficulty on account of the size of the left foot, and he had become very nervous. In September 1879, Dr. Phillippo took the case in hand, and prescribed gurjun oil. This was to be rubbed in (prepared with lime-water) over every part of the body—

hands, face, etc.—twice a day, bathing before each application. The washing off was done with sapolio. The rubbing was effected by the patient himself, that he might get the benefit of the exercise. The oil was also applied as an ointment to all swellings and ulcers; and when renewing it, cashew-nut oil was first applied and allowed to dry in. A tablespoonful of the gurjun oil, prepared with a smaller proportion of lime-water, was taken internally morning and evening. For an hour or two after rubbing in the oil the feeling was uncomfortable, and there was a pricking, warm sensation all over the body. In consequence of the difficulty of obtaining the oil at first, and of the frequent attacks of fever, sometimes lasting several weeks, it was impossible to rub it in continuously. It was, however, always used as an ointment. From 1880 the fever was accompanied by outbursts of bumps and eruptions on the fingers, toes, legs, and even face, and these would discharge plentifully, like the older enlargements, which became gradually smaller, and disappeared. The worst time was the latter part of 1880 until late in 1881. He was then very weak and nervous, and could not use the legs, or even stand upon them. To go from one room to another he had to sit on the floor and proceed with the help of hands and arms. He sometimes had pains in the knees. Attacks of fever and eruption were frequent. The nails were all gone, some of them leaving minute bits: the hairs on legs, arms, etc., and on the eyebrows were gone. In 1881, chaulmoogra oil was substituted for the gurjun internally, but the rubbings with the latter were continued. Improvement was first seen in the face; the lips, ears, and nose gradually becoming natural before the end of 1881. The spots about the body also began to disappear, and the hands were getting better: the left foot, and especially the great toe, was the last to yield. The outbursts continued even after the old enlargements had disappeared, but were less severe each time, until they ceased. From 1882 the gurjun oil was rubbed in only once a day. The treatment was kept up, with some intermissions, until January 1886, when, at last, he "ceased to live in grease". He was at that time cured, all symptoms having disappeared, and having regained the use of his limbs, and discarded the crutches, with which he had been able to get about since 1884. For upwards of five years he has now been quite free from any return of the old troubles: his strength has steadily increased, and general health improved; and although there are marks left of the old disease, the nails and hairs have been coming back; even the eyebrows have been slowly growing.

ON MALTA FEVER.

By A. G. P. GIPPS, Surgeon R.N.

(*Read: February 12th,* 1890.)

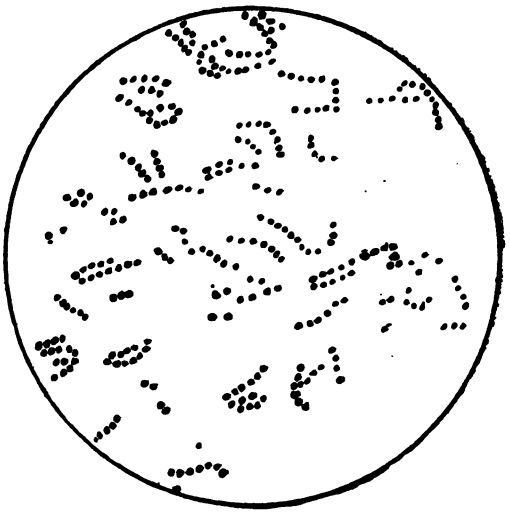
Mr. President and Gentlemen,—The disease of which I have made the following notes I propose to designate as "Malta fever", as distinguished entirely from all the other continued and intermittent fevers met with in various parts of the Mediterranean station. Excepting to those who have served in either service, and been stationed at Malta, the disease is comparatively unknown, as the cases which occur in England as either relapses, or even as a primary disease, generally come under the treatment of a naval or military medical officer. The disease may be defined as a specific fever, varying in intensity, sometimes continued for weeks without a remission, and at other times simulating a remittent form, the remissions being, however, of very short duration, and some two or three weeks apart.

The first point I would wish to bring forward is its cause. Like all these diseases, it is often attributed to cold, a wetting, exposure to the sun, bad water, smells from drains, and a specific malarial poison. From my own observation, I should unhesitatingly call it a "dirt fever", due to a long-continued stagnation of sewage, both in the harbour from the shipping and the fact that from days immemorial the whole porous stone of which the island is composed has been saturated with sewage—long previous to the introduction of the improvements in carrying the sewage out to sea. When it is considered that for six months in the year the fleet is moored in Malta harbour, and that some 6,000 or more men are perpetually during that time pouring their excreta into a tideless and very close harbour, in addition to which, all the year round, there are daily some ten to twenty large merchant steamers tied up in the harbour, representing some 1,000 to 2,000 men at least, also pouring their excreta into this harbour, it ceases to be any wonder that this much frequented place is one of the unhealthiest places in the world for an Englishman, and that whatever boasted improvements have been made in erecting pumping-stations, and pumping

the town sewage out to sea, it is impossible to prevent the state of affairs just described, and that it is no exaggeration to call Malta harbour one huge cesspool, never cleaned out, and holding the accumulation of many hundreds of years. With regard, therefore, to this fever having a connection with a specific poison (at present an unknown quantity) which is generated in Malta and Malta harbour I have not the slightest doubt, as the whole of the naval and military population, if not actually serving afloat, are constantly crossing and recrossing the water, to which source I consider the disease is attributable; and in this view I am much strengthened from the fact that the disease is not only much more frequent amongst naval officers and men than amongst the military, but the fever with the former is of a much more severe type.

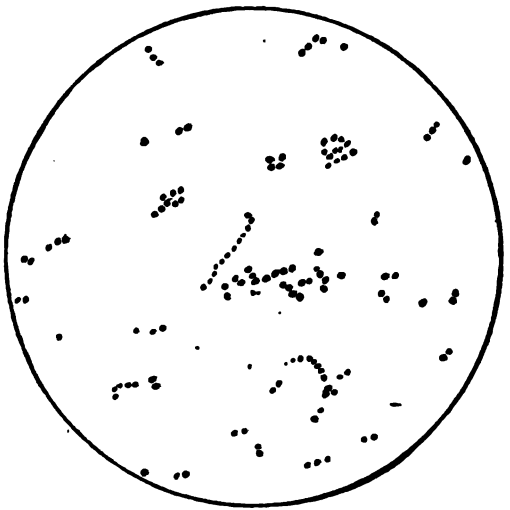
If, as I have stated, I consider this fever to be chiefly due to a poison emanating from the harbour, you will naturally ask me why, if the state of things is as bad as just described, large bodies of officers and men are not attacked simultaneously, instead of in more or less isolated cases. To this I would suggest, that, as I consider the disease to be due to a specific cause, so I think it requires a special state of the health (what is called "below par") to form a suitable bed for the poison to take root and flourish in. How often we see this in every-day life. People feel "seedy" and "out of sorts" some weeks before an attack of a definite illness, and in infectious and contagious diseases we see the illness spreading amongst a number who have been subjected to the same depressing or injurious influences, and leaving free the visiting medical man.

I have spoken of this disease as a specific one, due to a certain poison, and although hardly the right time to discuss the matter, it leads me to consider the disease from a bacteriological point of view. Some two years ago, my friend Surgeon Bruce thought there ought to be a definite micro-organism in this complaint, and he succeeded in isolating and making cultivations in Agar Agar of a minute micrococcus. This same germ he discovered in nine or ten cases of men who had died of this unadulterated fever, and whose *post mortem* showed no pathological appearances except those to be presently referred to. Not only that, but the growth in question was injected with sterilised broth into a monkey, with the result that this animal became severely affected with the disease, and on being killed (being in a moribund condition) the whole of the internal organs were found permeated with this specific micrococcus, which in its



Micrococcus of Malta Fever. Stained Gentian Violet.
× 1900.

This preparation made fourteen months ago; the micrococci have shrunk.

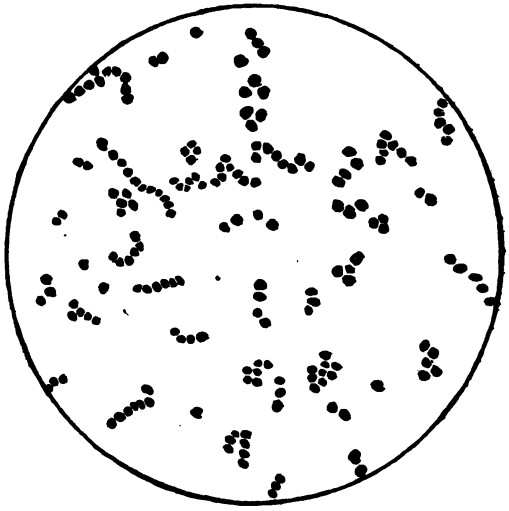


Micrococcus of Malta Fever. Stained Gentian Violet.
× 1400.

Put up eight months ago.

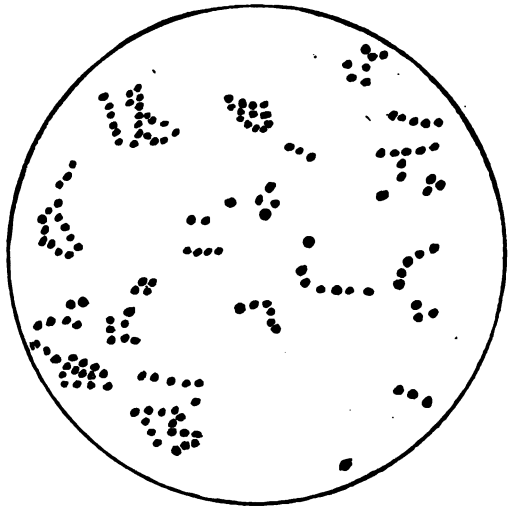
turn gave the typical appearance when cultivated on Agar Agar. Since Surgeon Bruce's experience (to whom I must apologise for quoting him without his permission) I have, in two cases of men who died of this disease uncomplicated, been able to verify his experience in finding the same micro-organism, drawings of which are herewith shown. In the present state, however, of the connection between micro-organisms and disease, but little really is known, and it is hard to say whether the varieties which are found in the many diseases now connected with them may not owe their diversity to the condition of the soil in which they are planted, instead of, so to speak, starting in life as an entirely different organism. The influence of soil and climate is seen to act so largely in producing varieties in animal and vegetable life, that I know no reason why the same may not apply to the micro-organisms, and as none of those engaged in producing (?) disease have been captured in their crude state outside the body in the air, it is hard to attribute their varieties to original differences inherent in them; but I am more inclined to the belief that they vary in many ways according to the condition of the soil in which they become implanted, that, in fact, their presence and diversity may be more effect than cause. I am, therefore, not altogether inclined to attribute this fever to the presence of these peculiar micro-organisms, but rather to associate them as the result of some specific poison, which, acting as a ferment, induces these peculiar forms of germs. That they are intimately connected (post or proper) with this disease there is no doubt. I must, however, apologise for this digression from the original subject, only calling attention to the presence (in the spleen, liver, etc.) of these micrococci, and leaving my hearers to deduce their own conclusions.

Whilst dealing with the probable source of Malta fever, which I attribute entirely to a poison emanating from the harbour (and therefore a peculiar poison, owing to the soil in which it is bred, whatever its origin), I would point out that even in the cases occurring amongst soldiers the origin of the attack in some cases has been directly traced to the harbour. Surgeon Bruce in his paper (*B. M. J.*, May 18, 1889) quotes the cases of two men being attacked ten days after bathing in a dirty part of the Grand Harbour. Also that of an officer exposed to the foul emanations in a dirty part of Quarantine Harbour. Again, whilst in 1886 the number of cases in the Station Hospital in Valetta treated was ninety-one, in 1887, 109, and in 1888 only forty-five, the returns from the navy for the three corresponding years are



Micrococcus of Malta Fever. Stained Gentian Violet.
× 1900.

Put up six weeks ago.



Micrococcus of Malta Fever. Stained Gentian Violet.
× 1900.

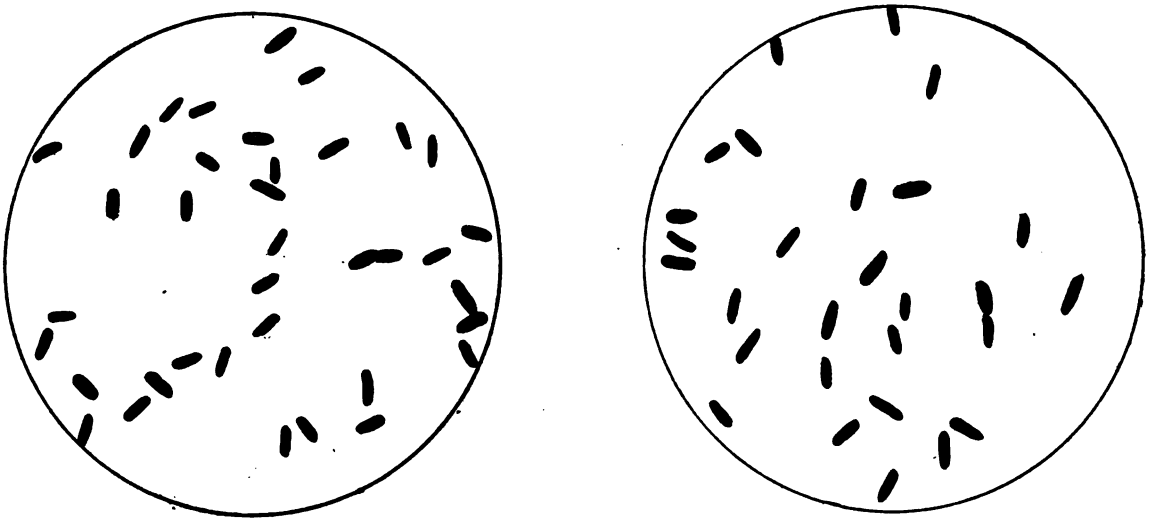
Mounted eight months ago.

DRAWINGS MADE BY THE AID OF AN ABBÉ CAMERA, MOUNTED ON ZEISS' MICROSCOPE.

for 1886, 373 S. C. fever—174 Rt. fever; for 1887, 271 S. C. fever—323 Rt. fever. This proves the greater tendency for the disease to occur in the persons of men employed altogether, and living in, the harbour.

Having now discussed the sources and probable causes of this fever, I would here state that from what I have seen of the disease that it is quite different from the various other fevers met with in the Mediterranean. Although the fleet visits all the ports in the various parts of that sea, and officers and men land in various healthy and unhealthy ports—in spite of this, when away from Malta for any length of time, there is almost a complete freedom from fever of any sort, except those cases which occur within some two or three weeks after leaving the island. This view of its being a disease peculiar to Malta is rather against the views held by some medical men; but, as against this, I suppose no one but a naval surgeon has such a good chance of seeing the results of visiting all the various ports in the Mediterranean, and so judging of their effects on the men under his own immediate observation, whereas it is only by comparing notes that any conclusion can be arrived at between the various medical men in the various ports, who can only from experience speak of the disease as it appears under their observation. That there is a great similarity between many of these fevers there is no doubt, but in the fleet the experience is that away from Malta, and visiting the many ports all over the station, the ships are comparatively, or almost, quite free of the disease. In fact, men leaving Malta affected with the disease often shake it off after a cruise in the Mediterranean itself.

Having now dealt at some length with the probable source of the disease, I would go on to the more practical part of it, viz., the symptoms as they are found to occur. I would here most emphatically express my belief that it is an entirely separate disease from typhoid fever; and I wish to condemn in unmeasured terms the term typho-malarial fever introduced by the College of Physicians into the nomenclature of diseases. That a case of typhoid fever is often (as far as the chart goes) influenced by the presence of this Malta fever, I do not wish to deny; but when the case is an undoubted one of typhoid fever (spots on abdomen, pea-soup stools, etc.), because the chart is not quite theoretically correct, to call it a case of "typho-malarial" is most incorrect, and the same refers to those cases of Malta fever in which, owing to a suppression of bile, and the motions becoming very pale, the question of typhoid arises, with no



Bacilli from a Growth made from the Kidney and Spleen, in a Case of Enteric Fever.
× 1900.

good grounds, and all other symptoms being wanting, the disease is returned as typho-malarial. As a matter of fact, the disease known as Malta fever I look upon as entirely distinct, and a pure unmixed disease in itself.

We will now deal with the symptoms as they arise. For some few days the patient has been feeling unwell, out of sorts. He complains of headache, a chilly feeling, the rigors being generally very indefinite, and lasting a long time, from two to six hours—not one or two severe rigors. The appetite is altogether lost. The bowels very often at the first onset of the disease are very loose, but after that as a rule constipated. The motions are often of a pipeclay colour, owing to a suppression of the biliary secretions. The two most marked symptoms, however, are severe lumbar pains and a peculiar condition of the tongue, which becomes quickly thickly coated with a yellowish white moist fur, clean at the extreme edges. This condition of the tongue is most valuable as a diagnostic sign, as it is not only present at the beginning, but very often persists in this condition during weeks of the fever, despite high temperature, irregular bowels, etc., and unlike the tongue in typhoid, which so frequently becomes brown, dry, and cracked. The pain in the lumbar region already mentioned is also a very constant symptom, but generally disappears about the third day. The temperature now attracts attention; this will be found at the outset to be exceptionally high. In fact, in the nine deaths which I have the pleasure to place before you, in only one did the temperature not reach 104° by the second day of observation.

Before introducing the question of the symptoms of the disease, I ought to have mentioned the period of incubation. I need hardly say that in a disease like that under discussion, where the victims are so constantly exposed to the poison, the question of period of incubation is a very difficult one to determine; but I had a most unfortunate opportunity in my own person of verifying the period in question. Leaving Malta on April 13th, 1889, and arriving in England on April 24th, on the 27th, when in the country, I was attacked with this disease in a typical form. Of course this is a single case, and all it probably proves is that the period is not under fourteen days, and probably runs between that and twenty-one days. In another case, the disease, of a very severe type, occurred seventeen days after leaving Malta (left May 29th —June 15th). These are the only two cases I can find bearing on the period of incubation.

To return to and sum up the symptoms. Headache, which persists; a prolonged and often a repeated rigor, not severe in

type; appetite lost; bowels, at first loose and colourless, become constipated; severe lumbar pains, and the peculiar creamy thick fur on the tongue, which is moist and flabby, and often remains in that peculiar condition for weeks. There is often at first bilious vomiting, but this generally passes off in a day or two. There are no abdominal symptoms. A short dry cough is often present, owing probably to the dry and irritable condition of the bronchi due to the high temperature. As the disease progresses, with the exception of the headache, all the other symptoms subside, the temperature alone showing the severity of the poison in the system. The urine will be found loaded with urates and phosphates, but I have never seen a case with albuminuria present, except in one severe one, where there were severe hæmorrhages from the tongue and gums, and probably in other parts of the body, causing albumen to be present in the urine. Sleeplessness is a very prominent symptom and a very troublesome one, as it assists to rapidly weaken a patient in a disease which already quickly pulls him down from the high temperature without any remission. Delirium of a muttering sort is almost always present, especially during the early part of the night, and is no doubt dependent on the high temperature, added to the great exhaustion. As the disease progresses, the patient very quickly becomes weak, emaciation being very rapid, and, unless great care be taken, bedsores will form. Lung, heart, or other complications, so common in other severe febrile complaints, I have never seen. There is a great loathing of food, and as this disease is one which rapidly exhausts the patient, it taxes the energy of the medical attendant to provide a diet small in quantity and at the same time nourishing. This will, however, be dealt with under treatment. The duration of the disease is most uncertain. In some cases it will last only some three weeks, whereas I have actually seen a very severe case which lasted five months, the temperature, with occasional remissions, being high the whole time. When once the patient finally shakes the fever off convalescence is fairly rapid. A previous attack no doubt predisposes to others, and even after years have elapsed, a patient exposed to any condition likely to physically weaken him is liable to a recurrence of the disease, the poison appearing to lie dormant in him. In prolonged cases the temperature will sometimes remain at the normal line for ten or fourteen days; but the patient, instead of benefiting by this remission, should a further attack be pending, remains in the same weak anæmic condition, and really seems still to be getting worse. As regards the temperature

itself, there is absolutely no rule as to the regularity of its rise and fall. As in all febrile diseases, it is, as a rule, some two or three degrees higher in the evening than in the morning, generally attaining its maximum about six P.M., but is always most irregular, as may be seen by the accompanying charts (shown at the meeting, but not reproduced). The pulse is, as a rule, very rapid, varying from ninety-six to 120, and, as the disease progresses, becomes very feeble and thready. Great anæmia is one of the characteristics of the disease in its later stages.

So far this describes the leading symptoms of the disease in its active stages. When convalescence sets in the temperature falls rather rapidly, and not gradually, as in most other febrile diseases.

I shall now proceed to the question of treatment; and here, alas! we must acknowledge, up to the present, great weakness. Despite the large number of drugs provided by the *Pharmacopœia,* and the many outside its list (and their number is legion), there is not one which can be said to have any lasting effect on this fever. In those cases where the temperature is high, and the skin not acting, antipyrine has proved of value, as this drug not only lowers the temperature rapidly, but it produces profuse action of the skin, and eases the severe headache and lumbar pains which always accompany the onset of the fever, and sometimes remain for days. Where the temperature reaches 104°-105° I have given this drug in scruple doses, two within an hour; and this will generally lower the temperature in about an hour some four degrees, and produce a feeling of comfort, from the relief of pain which follows its administration. Quinine in this disease is absolutely useless, and, in fact, worse than useless. This is agreed to by all observers. There is already sufficient gastric irritation present, without administering a bitter drug dissolved in an acid; added to which it has not the slightest effect on the fever. Aconite, diuretics, and diaphoretics are all equally inefficacious, and our treatment really resolves itself into an absence of any so-called medicines (the expectant method), and the treating of the various symptoms, as they arise, separately. The diarrhœa with which the disease sometimes sets in requires no treatment, and only generally lasts for twenty-four hours, to be followed by constipation; this is best treated by enemata. The rheumatism which almost invariably sets in in the later stages of the fever will be spoken of amongst the sequelæ. The great sleeplessness, which is one of the most trying symptoms, is best met with chloral and bromide

of potassium, though later experience with the administration of sulphonal points to this latter drug as being almost invaluable as a hypnotic. Little as I have said on the question of treatment by drugs, owing to, at present, our ignorance on the subject, the regulation of the diet claims our most important consideration; for experience has shown that nothing seems to have such a bad effect on a patient who is at all convalescing as anything injudicious in the way of food. Of course, in the acute and sub-acute stages of the disease, the diet must be of the lightest, such as milk, eggs beaten up, jellies, etc.; and stimulants in small quantities every three or four hours are necessary, in most cases, after the first few days, as weakness, with a small quick pulse, soon follows the onset of this disease. It is when the patient is convalescent, and the appetite is returning, that it is necessary to be most careful to avoid any indigestible food, as a relapse is almost certain to follow any injudicious indulgence in food or drink.

Of the sequelæ of this disease, the chief and most troublesome one is muscular rheumatism, and, like the fever itself, it is of a most intractable nature. The rheumatic affection is seldom articular; to patients affected with this complaint following the fever, drugs are useless. Tonics may be administered, to improve the general health; but what I have been told is most beneficial is a course of baths at one of the many German bathing-places. In my own case the rheumatic affection took the form of a sub-acute inflammation of the periosteum of both tibiæ, which became nodular, and so tender that I could not bear the weight of the bedclothes. There was no outward appearance of inflammation in skin over the nodes along front of tibia. Pains came on in the evening, and were severe at night. This condition lasted some fortnight or three weeks, and no drugs or local treatment had any effect. In some cases the rheumatic affection lasts for months, and is the cause of many men being invalided from the service. Another sequela is a prolonged anæmia; and the only thing which benefits this is the sending of the patients to England, where, in most cases, they recover. I have, however, seen several men invalided out of the service for prolonged debility and an anæmic condition, which did not yield to any treatment, or the administration of a liberal diet and stimulants. The patients seemed quite unable to shake off the poison. There are no other sequelæ of any importance.

Prognosis.—This, in the large number of cases, is favourable, though in some cases death is very rapid, following in

a few days after the onset of the fever. In the table of statistics for ten years, can be seen as accurately as can be made out the proportion of deaths to the cases occurring. The pathological conditions found *post mortem* at once serve to separate any question of confusing this fever with enteric. No inflammation or ulceration of the small intestine exists, and the only marked lesion is a great enlargement of the spleen, which is very soft and friable, and much engorged with blood; the liver is also found enlarged and softened. But beyond the affection of these two glands, no marked pathological condition is found. The actual number of *post-mortem* examinations is, of course, small, and the records of them smaller. Much remains to be done by those who have opportunities to make accurate records of all they find.

With regard to the time of year at which the disease is prevalent, there is abundant evidence to show that it is worst during the hot summer months, and gradually decreases as the cooler weather sets in. Taking Surgeon Bruce's statistics for eleven years at the Station Hospital at Valetta, both in January and in December, the admissions for this disease averaged 12; February, 13 cases; March, 20; April, 23; May, 75; June, 80; July, 102; August, 52; September, 42; October, 38; November, 32.

Again, in the "Health of the Navy" for 1887, in the Report from H.M.S. *Alexandra*, it is said: "The one constant factor which I have observed to be present in the evolution of this fever is heat, which evidently bears a close relation to the incidence of the disease." The same view is held, and is found to be practically the case, with all medical officers I have spoken to, and is quite in keeping with my idea that this disease is almost entirely generated in the stagnant and poisoned waters of Malta Harbour; the high temperature causing an increased evaporation from the surface, and causing an escape and setting free of the numerous poisonous gases held in solution at lower temperatures.

Before going on to the notes on the nine accompanying cases, I would here take the opportunity of calling in question the statement made by Surgeon Bruce as to one attack conferring immunity from a second. This is distinctly contradictory to the experience of naval medical and other officers; and so strongly is this held to be the case, that officers and men who have once had this fever are not sent back to the station till after a long time has elapsed. In fact, in the Naval Service, exactly the opposite view is held

to that just quoted, and, so far from one attack granting immunity, it is looked on as predisposing very strongly to a second and third attack; and I have myself seen many men who have had more than two separate attacks.

1886. "No specific treatment was found to be of any avail, and indeed the disease appears to run its course, uninfluenced by any medical treatment whatever." "A large proportion of the cases sent to hospital were subsequently invalided. Indeed, according to my experience, when a man has suffered severely from this fever he becomes liable to constant relapses, and is not likely to make a complete recovery or be fit for his ordinary duty until he has been removed from the station." This opinion is in accordance with that of all those medical officers who have seen much of the fever.

1887. The *Alexandra* again this year, as in the last, returns the largest number of cases of remittent fever, viz., seventy, with fifteen invalidings, and one death. The medical officer in his remarks writes: "As usual on this station, there is a greater proportion of sickness from remittent fever than from any other serious disease. The symptoms and progress of the cases under treatment were similar, in all essential respects, to the cases so frequently described in returns from this ship, and need not detain me further here. As usual, they varied much in intensity, some being of trifling importance, and of only a few days' duration, while others were of great severity. Most of the latter were either sent to hospital or, where the disease occurred again and again, invalided. A large proportion of those sent to hospital were subsequently invalided there; and those who returned on board nearly always suffered relapses, which made it necessary to send them back or to invalid them. Indeed, according to my experience, when a man has suffered from a severe or moderately severe attack of this fever it is hopeless to attempt to keep him on the station, and the sooner he is sent home the better it is for himself and for the efficiency and economy of the service. The tendency to relapse is a very common feature of this fever, which distinguishes it from ordinary continued fevers, such as enteric, with which, otherwise, it appears to me to be closely associated. Indeed, the term 'remittent fever', although for convenience commonly applied to it, is, I think, a misnomer, for the general and local symptoms are much more like those of 'continued' than of 'periodic' fever. As to the cause and even nature of this fever a great deal has yet, I fear, to be learned."

In the "Health of the Navy" for 1887 it is said, "Comparatively few cases occur away from Malta, except relapses." This, I think, is an established fact. Again, with regard to its similarity with other fevers in the Mediterranean, contracted at Gibraltar and other places, many medical authorities, such as Donaldson, Veale, Tomaselli (Catania), and many others quoted in the paper in the *British Medical Journal* of May 1889, assert that the fevers occurring in the respective places in which they practise are similar to the fever of Malta. In some degree this is possible, as the cause—viz., sewage in a tideless close harbour—is present in many of them, though in none approaching the degree found in Malta Harbour, owing to the presence of the large fleet, both of men-of-war and merchant ships. But the experience of naval medical officers is practically opposed to this, as, although all these ports are visited by the ships, and that during the hot summer weather, it is found that it is but very seldom cases of fever are contracted by the men when away from Malta, and then generally very shortly after leaving. In confirmation of this I would again quote from the "Health of the Navy" for 1887; in the report from the flagship it is said: "It is certain that the great majority of cases occur at, or immediately after leaving Malta, comparatively few cases, except relapses, occurring during the long summer cruise"; and I think that will be found to be generally the case, thus seeming to prove some difference, if not in the poison itself, at least in its virulence at the other ports in the Mediterranean.

With reference to my remarks as to the value of information obtained by letter from the various local practitioners in the Mediterranean, my views on their valuelessness are greatly borne out by the evidence given me by a naval medical officer, who himself met a Cretan and a Greek medical man. The first of these actually took him to see a case of Cretan (*sic*) fever (?), where the patient had pea-soup stools, abdominal spots, etc., and which was a typical case of typhoid disease, verified by death. I may here say this identical medical man had been in correspondence with an officer in the service, and showed my friend the inquiries made, and which he had answered, with reference to "Cretan fever". His observations must indeed have been perfectly valueless.

The second case to which I refer was that of an Englishman being treated by a local practitioner (Greek), who was treating him for what he called the "local fever". It was a pure case of ague, amenable to quinine. These two cases,

from a reliable observer, throw grave doubts on the statements of these various native practitioners, and who are held up as authorities for saying that "Malta fever" and the diseases occurring in their localities are one and the same: the truth being that they do not distinguish one febrile complaint from another.

Before closing this paper I would make the following condensed statement with regard to the disease under consideration:—

Firstly. I attribute its cause almost entirely to the discharge and accumulation of sewage from shipping in a hot, closed-in, stagnant harbour, a condition nowhere existing to the same degree as in Malta.

Secondly. This statement is largely borne out from the fact that although the sailors and marines, who live on the water, are away from Malta some six months in the year, and that during the hot summer months; still the disease appears to be much more prevalent amongst them than the troops who live on the shore, and are at Malta all the year round.

Thirdly. Almost all cases occur either at or shortly after leaving Malta.

Fourthly. The disease becomes more prevalent as the hot weather comes in.

Fifthly. As to the most prominent symptoms. A prolonged and often ill-defined rigor; clean tongue for first day or so, which then becomes thickly loaded with fur, and either remains in this condition throughout, or may suddenly become brown and dry during the third or fourth week—this latter condition is not general or lasting; severe lumbar pains in all cases; also at first frontal headache; diarrhœa may be present for the first twenty-four hours, but constipation is the most constant symptom throughout. There is an absence of any intestinal lesion of any sort, and no abdominal tenderness. The spleen and liver are always enlarged, especially in prolonged attacks.

The disease is often followed by rheumatism of a very obstinate character, more often muscular than articular; and a prolonged and persistent anæmic condition often remains.

The fever is quite unassailable by any known drug, the antipyretics acting only in that capacity. Quinine is not only quite useless, but is badly borne by the patient. And, lastly, I believe that a previous attack predisposes to another.

Herewith I have shown the charts* bearing on the cases quoted, also some tables of statistics* for ten years; these

* Shown at the meeting, but not reproduced here.

latter are of necessity not perfect, owing to the fact that the majority of these cases in the naval returns are placed under the heading of remittent fever. A large number of cases of "simple continued fever" are also shown, and as these also contain some of the cases of Malta fever, I have given them in a separate column in the return. Illustrations of the micrococcus, drawn by aid of the camera (see pages 78, 80, 82), and also a chart of Malta harbour (not reproduced), showing well its confined nature, complete the adjuncts to this paper.

In reference to the tabular statement for ten years, 1878-87, I would call your attention to two facts.

Firstly. That owing to the form of the returns I am unable accurately to classify the diseases, especially as in 1882 the large increase was due to the ships being employed off Alexandria and Port Said.

Secondly. The list of cases of enteric fever occurring in the respective years entirely disagrees with Surgeon Bruce's experience, that the Malta (or remittent in our returns) fever in any way is less in those years when enteric is prevalent. Although, no doubt, there are many cases in these tables contracted elsewhere than at Malta, still there is no doubt that probably 75 per cent. of them are contracted there, as the evidence I have already given proves.

These tables show how much more the naval men suffer than their brethren in the army.

Marked Differences between Enteric Fever and Malta Fever.

Enteric Fever.	Malta Fever.
Incubation, 14 to 21 days.	Incubation, 14 to 21 days (?).
Irregular chills.	Prolonged rigor.
Diarrhœa and abdominal pains.	Constipation almost always, and throughout the attack. No abdominal pains.
Iliac tenderness (right), and gurgling.	No iliac tenderness or gurgling.
Roseolar rash appearing in crops.	No rash.
Tongue soon becomes dry and brown.	Tongue generally remains moist, and coated with a white fur. Brown state of tongue, if present, not lasting, unless in fatal cases.
Hæmorrhage from bowel, and pea-soup coloured motions.	No hæmorrhage, and motions, if pale, of a pipe-clay nature.
Disease lasts a definite period.	Disease often goes on for months.
Fever generally limited to one attack. Two attacks, even at very long intervals, rare.	Liable to frequent repetition of fever.
Pathological conditions well marked and typical.	Pathological conditions limited to enlargement of spleen and liver. No ulceration or trace of inflammation in small intestines.

It only remains to me to apologise to you for the length, and probably rambling nature of my paper, and to plead in excuse my want of experience in writing and reading papers, and to thank you for the patience with which you have listened to me. I regret to say that I fear that as long as the present state of affairs goes on, so long will Malta fever flourish in the persons of our sailors and soldiers.

ON THE USE OF THE OIL OF EUCALYPTUS GLOBULUS IN SCARLET FEVER AND OTHER INFECTIOUS DISEASES.

By J. B. CURGENVEN, M.R.C.S.

(*Read: March 12th*, 1890.)

I MUST apologise to the members for reading to them a disjointed paper, as it has been written at odd moments as time could be snatched from the absorbing occupation of attendance on patients suffering from the late epidemic of influenza.

Everyone must acknowledge the importance of the subject of disinfection in cases of scarlet fever and other infectious diseases, especially so as, within the last few years, considerable sums of public money have been, and are being now, spent in erecting large fever hospitals for these cases. I hope to show that, by a method of disinfection which I have practised for nearly twelve months, this heavy burden on the ratepayers may be saved, and the cases treated in their own homes without risk to those around them.

The disinfectant that I have used is eucalyptus oil with thymol and other camphors and aromatic antiseptics in solution in definite proportions, much stronger than has been found by experiment to be sufficient, singly, to destroy anthrax spores, bacilli, and bacteriæ; and I consider that for all infectious diseases no stronger or safer disinfectant could be used. These aromatic and camphoraceous disinfectants, mixed with olive oil, fats, vaseline, or alcohol to the extent of five per cent., have no influence on bacilli or bacteriæ.

MM. Widal and Chantemesse, in a series of careful researches on the bacillus of diphtheria, have observed that the solution of Dr. Soulez, which consists of 5 grammes of carbolic acid, 20 grammes of camphor, and 30 grammes of olive oil, does not arrest the cultivation of the bacillus, but renders it slower. These investigators think that this negative result is owing to the presence of the olive oil.

Dr. Davis, in the *Medical Annual*, 1890, says: "The inertness of carbolic and thymol oils is remarkable, but does not contraindicate their use as a local application in the desquamative stages of eruptive fevers to prevent contamination of the air by infectious particles. As the action is probably mechanical, inunction with vaseline would perhaps suffice; but the addition of thymol or carbolic or camphor may possibly be more grateful to the patient." His idea in the use of these disinfectants was that they simply rendered the oil or vaseline "more grateful to the patient" in carrying out the method of inunction as proposed by the late Dr. Budd of Bristol. That method I have tried, but the oil soon became rancid from the heat of the body, and the linen had to be changed every day; while, if it prevented the cuticle from dispersion in the air, it could not prevent the infective germs from passing freely from the patient in his breath and perspiration.

Dr. Bucholtz found eucalyptus oil to be three times stronger than carbolic acid, for while the latter required a strength of 1 in 200 to prevent putrefaction, eucalyptus oil only required a strength of 1 in 666 to produce the same effect. Siegen found that blood to which one-third per cent. of the oil had been added was odourless at the end of ten days. Dr. Lascelles Scott says that it is three and a half times more powerful than carbolic acid as a bacterial antiseptic. Mr. Mayo Robson proved by experiments that the vapour of eucalyptus oil given off at the ordinary temperature of the air preserved sterilised hay-infusion from the development of bacteriæ, and he says, "it may so saturate the air as to kill all infective particles, not only bacteriæ and micrococci, but also the germs of fevers and other infectious diseases.

"The vapour of carbolic acid at ordinary temperatures", Dr. Franklin Parsons tells us, "had no destructive effect on spore-bearing bacilli, though some effect was produced at elevated temperatures." Of what use, then, is the carbolic sheet over the door, and the vapour of carbolic acid in the air of the room occupied by a scarlet-fever patient?

Professor Lister in 1881, when in the chair of the Clinical Society, said: "It had been stated that there was no antiseptic that could with safety replace carbolic acid, though several had been tried, but he was in a position to say that the oil of eucalyptus globulus, if used properly, is a powerful and perfectly reliable antiseptic, and is also quite unirritating and without toxic effects."

Dr. Lauder Brunton, in his Croonian Lectures in 1889,

said that "it is not, moreover, *à priori* impossible to imagine that antiseptics circulating in the blood-stream may be germicidal to pathogenic organisms, the results of which are seen in disease. Up to the present time, however, all trials with such an idea seem to have been without beneficial effect."

My experience proves that the vapour of eucalyptus destroys not only the spores of the pathogenic bacillus of scarlet fever, but the bacillus itself after it has set up the pathological train of symptoms constituting the fever, and is being rapidly generated in the blood and tissues of the patient.

Thymol and other disinfectants, when dissolved in an essential oil, retain their power; and a combination of these aromatic and camphoraceous disinfectants forms as powerful a solution as can be required for the destruction of any infectious poison. It was an axiom of Dr. Paris that a combination of several therapeutic agents, in smaller proportion than is required by any one singly to take effect, produces a far greater and a better effect than any one in a larger proportion. The same rule is applicable to disinfectants; a better and a stronger effect is obtained by mixing several together, for while any one singly of the strength used would have no effect, their combined action is most powerful. I only state a well-established fact, that all the essential and balsamic oils of aromatic trees and plants are excellent antiseptics, they readily volatilise, and in doing so liberate ozone, thus exercising powerful antiseptic influence. This power of liberating ozone makes eucalyptus and other aromatic oils valuable for use in sick-rooms, and in fact in all rooms that are continuously occupied. They act better if diffused through the air by means of a spray diffuser. If the bedroom and the pillows are sprayed at night the sleeper will sleep more comfortably, and awake in the morning more refreshed from sleeping in an ozonised atmosphere.

Eucalyptus is a true disinfectant, as it has the power of destroying the active matter or the infective germs generated in and discharged by a person passing through any of the eruptive or infectious fevers, and which, received by a healthy person into his system, develops the same train of symptoms, the same fever from which the former was suffering. Eucalyptus destroys the malarial poisons, which in the human system develop the various short or long malarial fevers, such as ague, jungle fever, Roman fever, rock fever, influenza, etc.; of this we may now rest assured from the experience gained in Italy, Africa, India, and America, by planting the tree extensively in malarial dis-

tricts. In California thousands of acres have been planted, and the Americans are yearly extending their plantations, surrounding their houses and locations with the trees. It is easy to foresee that our chief supply of the oil of eucalyptus globulus, which is the only tree of the species they plant, will in future be derived from that country rather than from its native *habitat*, Australia. The Australians having the native forests for their supply, do not feel the stimulus to plant, and their supply will diminish.

It is more than twenty years since that Dr. Budd published a pamphlet advocating the use of olive oil for inunction in scarlet fever, not with the view of destroying the infective germs, but of saturating the cuticle and preventing it from being diffused through the air. The use of the oil was attended by great inconvenience, in that it soiled the linen and became rapidly rancid by the high temperature of the patient. Since that time I have sought some method of disinfection by inunction that would destroy all the infective germs stored in the cuticle, so as to render it when cast off perfectly innocuous. There were many disinfectants—carbolic acid, permanganate of potash, creolin (Jeyes' fluid), sanitas, etc., but none of these were suitable. Carbolic acid must be dissolved in water, oil, or fat. A watery solution of a disinfectant would not do to apply to the whole surface of the skin of a child in the first stage of scarlet fever with a temperature of 103° to 105°, and the carbolic acid could not be used strong enough to destroy the infection owing to its caustic nature. For the above reason Jeyes' fluid, sanitas, and other watery solutions were unsuitable. Antiseptics mixed with fixed oils or fat were attended by several objections. The oil or fat applied to the whole surface would interfere materially with the action of the skin, and the oil or fat would weaken their power. Spirituous solutions were also unsuitable, and the alcohol weakened their action.

Corporeal disinfection by inunction has been tried by medical men at various times. One recommended thymol mixed with vaseline, but the unctious nature of the latter was disagreeable to the patient, and if applied to large surfaces of the body interfered with transpiration. No one would be surprised that the trial was a failure.

In June last there was published, in the *Medical Record*, a method of disinfection proposed by Dr. L. Mervin Mans. He says: "Sponge the patient thoroughly, morning and evening, with a tepid solution of corrosive sublimate, 4 to 1,000, as soon as the eruption makes its appearance. The hair and the secretions are also to be disinfected with the same. As

soon as the patient is permitted to leave the bed, have the body washed with warm water and soap, then sponged with the 1 to 4,000 bichloride solution, wiped dry, and anointed with the following ointment—

Sodii biboratis, zinci oxidi āā ʒ iv.
Ol. Gaultheriæ ♃ ss., vaseline ℥ iv.

This treatment is to be continued until desquamation is complete.

We have no record of the success of this treatment, nor of the number of deaths after the use of this poisonous disinfectant. I should think that no man of ordinary intelligence would venture to use a solution of bichloride of mercury of 4 to 1,000 strength twice a day for upwards of a week, applying it over the whole surface of the body of a young child, and continuing a weaker, though still strong, solution of 1 in 4,000 for several weeks longer, anointing the body also daily with a vaseline ointment that would most seriously interfere with the proper action of the skin. One German physician applies a bichloride of mercury solution to the pustules of small-pox, and another covers them with an ointment of salicylic acid, starch, and glycerine. Another, Dr. Bianchi, recommends in small-pox, baths and washings in water containing five per cent. of boric acid, and "the whole body is to be washed, using a clean sponge, with a 1 to 1,000 solution of corrosive sublimate." . . . . . "In mild cases the whole body is to be washed once with the corrosive sublimate solution, and twice with the boric acid solution, in the twenty-four hours. In grave cases, twice with each solution daily." After washing, all the parts covered with eruption to be smeared with an iodoform ointment, 1.5 per cent. He does not say how many of the ninety-six cases so treated recovered or died. He says the treatment is rational; it diminishes the period of the eruption; practically isolates the patient; prevents suppuration; and limits contagion. What Dr. Bianchi claims for his corrosive sublimate treatment I claim for eucalyptus; and, although I have not had an opportunity of testing it, I firmly believe, from the power it possesses of killing the scarlet-fever poison, it would be equally powerful over small-pox. In the one case we are using a powerfully poisonous disinfectant, in the other one that is quite innocuous to the patient. These methods of disinfection have been made public since I commenced the treatment of scarlet fever by inunction. I had for some years given up the idea of disinfecting the skin through inability to find a suitable medium for applying the disin-

fectant, when, in May of last year, I was in a difficulty as to how I should isolate a child suffering from scarlet fever in a family where there were six other children. The child was a year and nine months old, the youngest of the family. The mother would not hear of its being sent to the hospital, and it was impossible to carry out any isolation in the usual way, as she had to attend to all the wants of the other children. I told her that all the children would have the disease if she kept the child in the house, but she said she would not part with her baby, and would risk the others having it. In this emergency I again thought of disinfecting the child, when I remembered having at my house a sample of Tucker's eucalyptus disinfectant, composed, as before stated, of essential oil and camphors, having no fixed oil nor alcohol in it. I determined to try it, and told the mother how I wished it used. She was to rub the child all over with it night and morning, not omitting any portion of the skin, and to sprinkle the bed and the floor of the room with it, so that the air should smell strongly of the vapour. I also gave the child eucalyptus oil in one-drop doses every four hours in an emulsion. When I first saw the child it had the scarlet-fever rash over the face, arms, and upper portion of the body. Its throat was so sore that it refused all food, and had not taken anything for two days; it had not slept during two days and nights, being fretful and crying all the time. On my second visit, the following morning, I found the child sitting up in bed eating a slice of bread and butter. The rash had all gone, and the temperature had gone down from 105° to 100.2°. The mother told me that after rubbing the child over with the fluid the previous night, it went to sleep and slept five hours, awaking apparently well, taking some milk without any difficulty in swallowing. I was quite astonished to see such a change in the child, and told the mother to go on with the disinfectant, rubbing it over night and morning for three days, then each night, after a warm bath, for four days more. The child was so saturated with the eucalyptus inunction, by inhalation of its volatile vapour, and by medication, that the disease appeared to have been stayed and every germ destroyed, as desquamation occurred only on the parts of the skin where the rash was seen. The other children had free access to the room, and none of them took the disease.

Several other cases were treated in a similar manner with like results. The fever abated after the first inunction, and the rash disappeared within twelve hours; desquamation occurring only where the rash had been seen on the

commencement of the treatment. None of the cases were isolated, other members of the family frequenting the room, and in one case a mother with a younger child living in the single room. I shall only relate other cases in detail which serve to illustrate the conclusions at which I have arrived as to the power of eucalyptus over the scarlet-fever poison, and, by analogy of action, over the pathogenic germs of all eruptive and malarial fevers.

The next case I shall relate was a boy eight years old. When first seen he had had the scarlet-fever rash out two days. A brother had been sleeping with him, and two other brothers occupied the same room; while the mother, and a sister six years old, slept in the sitting-room. The boy was anointed with the disinfectant, and sent to the hospital. The three other boys and the girl were directed to use the disinfectant for a week, rubbing it over their chests and sprinkling it on their shirt-fronts and about the room, that they might inhale the vapour continuously during the day; and sprinkling it over their pillows and sheets, that they might sleep in the midst of the vapour at night. The second day after the boy was removed the sister showed symptoms of the disease. She vomited, had a headache, a white furred tongue, and sore-throat. Her temperature was 103°, and pulse 118. My son, who saw her, told her she would have to go to the hospital unless she used plenty of the disinfectant and stopped the fever. She said she would not go to the hospital, so she took the bottle and saturated the pillow and sheets with the fluid. For the remainder of the day and the following night she breathed air saturated with the vapour, sleeping quietly. She was given two-drop doses of the oil in emulsion every four hours. When seen on the following day all symptoms of the fever had gone; no rash had appeared; her temperature was normal; she felt quite well, and had no recurrence of fever. She was given a warm bath, and the disinfectant was rubbed over the whole surface of the body as a precaution. The others all escaped the disease, and the boy sent to the hospital was kept six weeks at the public expense.

The next case was a nurse in a family where there were three young children. When first seen she had the scarlet-fever rash out over her chest and arms; a sore-throat and headache having commenced about thirty-six hours previously. She was removed to the hospital, and Tucker's eucalyptus disinfectant was ordered to be freely used in the nursery. The children were kept in an atmosphere strongly impregnated with the eucalyptus vapour for three days and

nights. After that they were allowed out during the day. The use of the disinfectant was continued in the nursery for four or five days longer, when the children were considered safe from the development of the fever through any infection from the nurse.

The last case I shall relate is that of a girl about eleven years of age. When first seen, on the third day of the fever, the rash was fully out; the throat was very inflamed and swollen, and the tonsils were ulcerated. The temperature was over 104°; the pulse 132. She had much difficulty in swallowing, and took very little nourishment. The eucalyptus fluid was freely sprinkled over the bed and about the room; it was rubbed over her whole body night and morning for three days, and then at night only for seven or eight days more. She took also three-drop doses of the oil every four hours. She felt relieved directly after the treatment was commenced, and the following day she could drink with less pain; but the ulcers did not heal for three days. The rash did not disappear, as in the other cases, but became very bright for two days, and then gradually faded. Desquamation commenced before the rash had disappeared, and finished on the fifteenth day. She had rheumatism in her wrists and ankles for a few days; these were rubbed with the eucalyptus. The glands on the left side of the neck swelled and were painful, the side on which the tonsil was most ulcerated. These glands were lightly rubbed every four hours with the fluid, and in a few days the swelling subsided. She had no albumen in her urine, which was examined daily from the fourteenth to the twentieth days, and on the twenty-first day she left London for Brighton. A sister of this girl slept with her until I saw her on the third day; after that she did not sleep with her, but I told the mother she had better spend much of her time in the same room, that she might inhale the vapour of the disinfectant continuously, with the view of destroying any of the fever poison she might have taken from her sister. She spent most of the first three days in the room, sitting by her sister's bed, and reading to her. On the 31st of October I felt bound to conform to the provisions of the new Act. I reported the case to the Sanitary Authority, and separated the two sisters. Two days afterwards, which was five days from the date that they ceased to sleep together, the sister showed some signs of the disease. She had headache, sickness, and a coated tongue, and felt very ill. I used the disinfectant freely about her, and at the end of the second day she was well again. There were three

other children in the house, but none of them took the infection. There was no sheet used over the door, the disinfection of the patient serving to isolate her from those close to her bedside. The vapour of the disinfectant inhaled with every breath destroyed all the infective germs proceeding from the mucous membrane of the mouth, throat, or nose. The inunction of the skin destroyed all infection proceeding from the surface of the body, and the secretions were all disinfected immediately after they were passed. With an atmosphere full of this powerful disinfectant, there is no need for the doctor or nurse to take those elaborate precautions against the risk of conveying infection to others that amateur sanitarians so strongly recommend in the daily press. The aromatic disinfectants are eliminated chiefly through the kidneys; in this way they destroy the germs stored in the epithelium of those organs, and it is hoped we shall find by further experience that it will prevent the development of desquamative nephritis, with its attendant danger to life and health. Those cases that I have treated have not had any symptoms of nephritis, nor the slightest trace of albumen in their urine. From the experience gained by the above treatment of scarlet fever during the last twelve months, I have determined the following conclusions:—

1. That no isolation of the patient in the way now practised is necessary. The skin, mucous membranes, secretions, and breath being so disinfected that he cannot communicate the disease to others, although daily in the same room.

2. In cases treated by this method of inunction during the first day of the fever the disease is arrested: no rash appears and no desquamation follows, the inhalation of the vapour being sufficient to produce this result. It is probable that in such cases so checked the patients may be protected from another attack, as by inoculation.

3. Children who have been exposed to the infection for two or three days, by inhaling the vapour diffused in the air of their rooms, are preserved from the disease.

4. The sequelæ are lightened and prevented, desquamation is hastened, the falling cuticle being incapable of conveying the disease through its complete disinfection; consequently it is not necessary to enforce six or eight weeks' isolation until its completion.

5. The specific fever and the development of the germs of the disease terminating in six or seven days, the skin and mucous membranes being kept under the influence of the disinfectant until the tenth day, the patient is then safe to mix with others.

6. The bedding requires no further disinfection, as it is thoroughly disinfected during the treatment of the patient. The volatile vapour penetrates every article, even the mattress. The room also requires no after disinfection, as every germ that escapes from the patient is killed by the vapour.

I find that to extend this paper further on the treatment of other infectious diseases by eucalyptus would take up too much of your time this evening. I will therefore merely observe that eucalyptus has been used most successfully in the treatment of diphtheria by Dr. Jules Simon and other French physicians; by Dr. Murray Gibbes in New Plymouth, who used the fresh leaves; and lately it has been successfully treated in an outbreak at Uxbridge.

It has been equally efficacious in whooping-cough when tried by Dr. William Hardewick and others.

In my own experience it prevents the spreading of the infection of measles and chicken-pox.

It protects from malarial fever and influenza those daily inhaling the vapour, and sleeping in an atmosphere of it at night; and, lastly,—I believe it would destroy the infective germs of small-pox.

EPIDEMIC INFLUENZA IN FRANCE.

By JACQUES BERTILLON, M.D., Chief of the Municipal Statistical Department of Paris.

(*Read: April 23rd,* 1890.)

ABSTRACT.

THE statistics of deaths caused by the recent epidemic of influenza would be misleading, were we only to reckon the mortality of that disease from the deaths contained in the returns sent in by medical men. Thus, in Paris, the excess of mortality in the months of December and January last, beyond the ordinary mortality, was at least 5,500. Of this number 213 only were attributed by the certifying medical attendants to influenza. It was so likewise in London, Berlin, and other large cities. This arises from influenza being very protean in form, and from its only being dangerous from its complications.

To reckon the deaths due to this cause, we must deduct from the number of deaths recorded in times of this epidemic the average number which occur in normal periods. The difference between the two numbers reveals the number of deaths resulting directly or indirectly from the disease.

In a moiety of the cases influenza causes death by reason of pulmonary complications (pneumonia, bronchitis, pleurisy, and pulmonary apoplexy). It greatly increases the severity of the following chronic diseases, and doubles the danger of sudden death from them, viz., pulmonary consumption, diabetes, alcoholism, softening of the brain, general paralysis, organic diseases of the heart, and senility. On the other hand, it has no influence on ordinary epidemics (typhoid fever, variola, measles, scarlatina, whooping-cough, and diphtheria), except as tending to the onset of pulmonary complications in those maladies.

It is not dangerous to children, but becomes so after the age of twenty years, and nearly doubles the mortality of every age beyond that period. It is only half as dangerous to life in women as in men. It attacks equally all classes of society. Rich and poor, so unequally affected by other classes of illness, are attacked in like proportions by influenza.

Relatively to other nations, England has been spared; but the disease has attacked with greater severity the West than the East of Central Europe.

NOTES ON AN OUTBREAK OF INFLUENZA IN A POOR-LAW SCHOOL.

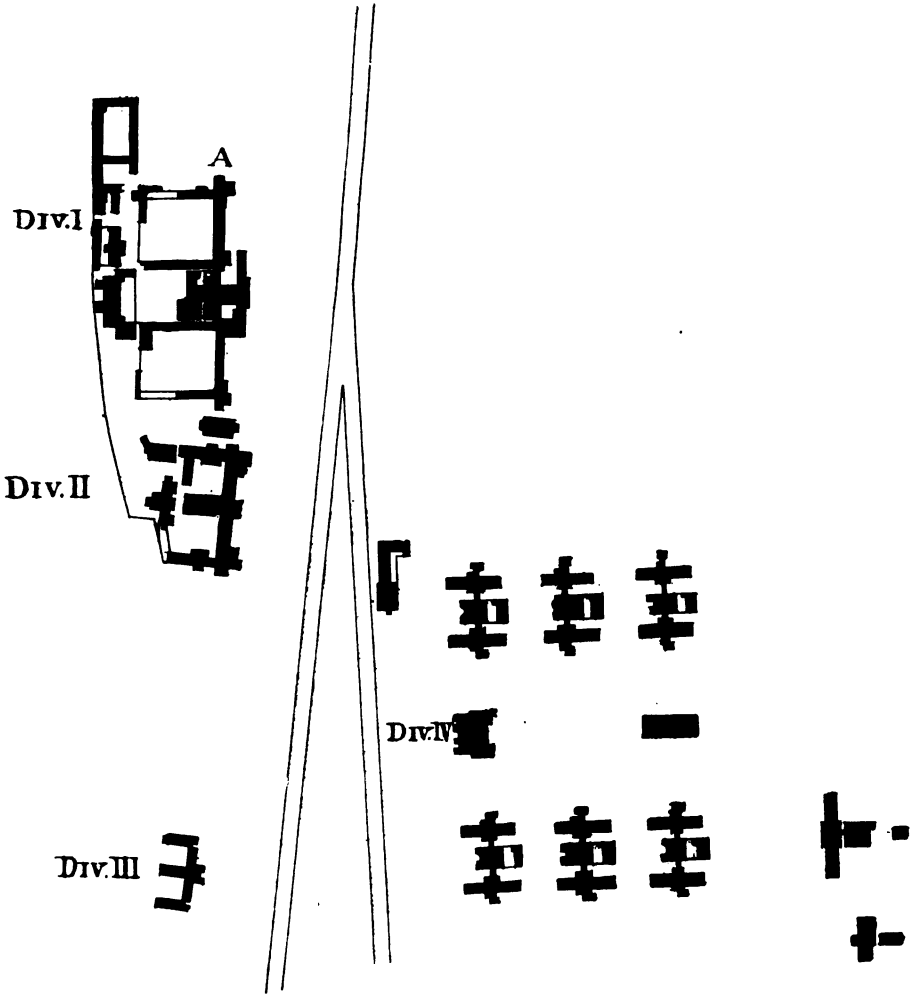
By GEORGE RICE, M.B., C.M., Medical Officer South Metropolitan District Schools.

(*Read: April 23rd*, 1890.)

In tracing the history and recording the facts of an epidemic which recently occurred in the South Metropolitan District Schools, Sutton, Surrey, it is necessary, in the first place, to give you some idea of the institution and its management.

Situated on high, chalky ground on the southernmost boundary of the parish, there are what I may term two sections, under separate superintendence. On the west side of the old Brighton Road are the schools for boys from eight to sixteen, infants from four to eight, and the probationary wards, to which all the new-comers are sent for a fortnight's quarantine. On the east side of a branch of the same road, at about six hundred yards distance from the before-mentioned buildings, lie the schools for girls from eight to sixteen years of age, where they are educated and trained for domestic service. These are called the Banstead Road Schools, as distinguished from the Brighton Road Schools before spoken of. In the latter, the boys occupy the most northerly building, the seniors, from eleven to sixteen, being on the right as you look west, and the juniors on the left. The infants occupy separate buildings with the same frontage, but more to the south, the chapel intervening. The probationary wards are 250 yards further south. One superintendent governs all these departments on the Brighton Road side, the infants and probationary wards having each its own separate staff of officers and attendants under a matron. There is also a large farm, with a number of cows, pigs, and horses, and workshops, where the senior boys are taught trades, such as tailoring, shoemaking, baking, carpentering, fitting-work, etc. The men connected with these different occupations, to the number of fifty-seven, live outside the place, in the village of Sutton.

As influenza had existed in the said village a fortnight or



SOUTH METROPOLITAN DISTRICT SCHOOLS,
SUTTON, SURREY.

three weeks before its appearance in the schools, it is absolutely necessary to first ascertain whether it was introduced by any of these outdoor servants. I think, however, I shall be able to show you that those affected were infected within the schools.

About a fortnight before Christmas, the cow-keeper living in a portion of the main building, which we may call division 1, suffered from an attack of bronchitis, to which he has always been subject at this time of the year, and for which I treated him in the usual way. The day before Christmas his wife complained of nasal and lachrymal catarrh, with rheumatic pains, feeling very ill. She keeps a sort of sweet-shop in her quarters, and is allowed to go among the children to sell her wares. On this day (Christmas Eve) she went among the senior and junior boys. On Christmas Day she was compelled to lie in bed much longer than usual, and expressed herself as never having had such a cold in her life before; but on Thursday (Boxing Day) she carried on her business as usual.

On the following Monday (December 30th, 1889), two maids, employed in the main kitchen of division 1, visited her in her quarters, and between this and New Year's Day some of the main laundry maids employed in the same division also went there to deal with her.

On January 2nd one of the latter was seized with severe headache, nasal and lachrymal catarrh, rheumatic pains in the back and legs, with a scarlatiniform rash lasting a few hours. On the same day one of the kitchen maids was confined to her bed with headache and prostration. A number of the boys are employed to assist in the kitchen and dining-hall, and one of these was attacked next day, as was also the other kitchen-maid.

The cow-keeper has sixteen boys (half-timers) under him, to help in looking after and milking the cows, and four specially to take care of the pigs. He states positively (and the farm-bailiff confirms this) that nothing has been wrong with any of the animals under his care. At the same time all the pig-boys and two-thirds of the cow-boys were seized with symptoms similar to those of the kitchen employés. These pig and cow-boys have, in the course of their work, to visit the kitchen and dining-hall several times each day. While there, necessarily they come in contact with the officers and boys employed there. It has previously been mentioned that the first persons seized were those connected with this department, and the pig and cow-boys did not seem to be affected till three days afterwards. They are all

boys about the same age, and probably equally susceptible to causes of infection. It appears obvious, therefore, that the pig and cow-boys were infected by those employed about the kitchen, and not by the animals with which they had to deal.

The veterinary inspector of this district had told me previously that influenza of a mild type had been prevalent among the draught horses in the neighbourhood, but he had heard of nothing similar among the cows or pigs. The cowman's wife had been once to Sutton and once to Croydon within about ten days of her illness, but I can trace no probable source of infection from these visits. The proportion of cow and pig-boys attacked seems, however, a large one.

On the farm are employed nine men and seventeen boys. There are also five horses, looked after by the horse-keeper, and six boys. Only one of the stable-boys and four of the farm boys were attacked, while all the men escaped.

Before I go further, allow me to say that it is not incumbent on me to attend professionally any of the officers or servants, and therefore a good deal of my information has been obtained, through the superintendent, from the officers themselves.

To return to the servants in the centre of division 1. Three other laundry-maids were seized on the 6th January, and the cook followed next day. The affection then spread right and left ; the dormitory-maids (of whom there are eight) and three of the schoolmasters (one non-resident), out of twelve, succeeding at intervals of a few days. The trades of shoemaking, tailoring, and carpentering are carried on in a separate and detached building to the rear of division 1. The shoemaker was taken ill with symptoms of influenza, which compelled him to leave work on the 7th January, and which kept him away for a week. These symptoms were pains in head and joints, and the back of his eyes. He has forty boys working under him, also half-timers, twenty each day. The first of these was attacked on the 6th January, and from this date fourteen were affected. The head tailor began to complain about the 14th, but was able to keep at his work till January 24th. There is no history of illness at his home. He also has forty boys under him, the first of them being seized with illness on the 6th, and fourteen also of these were ill between this time and the 17th January. The carpenter fell ill on the 2nd February, and was compelled to leave work on the 5th, his family having previously suffered. One of his sons, aged 16, was attacked on January 23rd, and one,

aged 18, on the 24th ; two girls, of 12 and 9, on the 30th ; his daughter, aged 21, on the 2nd February, and his wife on the 3rd. Here, again, the boys were attacked on the 6th January, and five out of twelve suffered.

There were five other outdoor officers, in addition to those mentioned, compelled to stop away from work through illness, one on January 9th, one on the 10th and 11th, one on the 13th, and one on the 20th, but there was no previous history of recent illness in their families.

In the kitchen and dining-hall of division 1 there are employed five officers and thirty-three boys. I have already referred to the illness of the officers, and the different dates of their seizure ; and of the boys there were twelve infected, the first being attacked on the 3rd and the last on the 9th January.

The tailors, shoemaker, and carpenter have one common mess-room, where they cook and eat their meals. All the boys, senior and junior, mess together in one dining-hall, and play together in their respective yards. Now the first hall boy was attacked on the 3rd January, the first tailor's boy on the 5th, the first carpenter's boy on the 5th, and three shoemaker's boys on the 6th. The shoemaker himself was attacked on the 7th, the tailor not for a fortnight, and the carpenter not until the 2nd of the next month. The long interval between these attacks appears to me to show that the boys themselves, and not the officers, were the source of infection. Of the fifty-seven band-boys, nineteen were absent from duty from January 4th to January 11th, the band-master himself escaping. There are two bakers, who train twenty boys; they escaped, but four of the boys were attacked between the 6th and 8th January. To sum up respecting the boys, the whole number of seniors under treatment was 139, and of juniors 122. All, with one or two exceptions, recovered rapidly.

The first case occurring in the infants' department, which we may call division 2, was that of a teacher, and I believe her to have been infected in the following manner. An officer from the girls', or Banstead Road schools, had visited some friends in Sutton who were suffering from influenza on the 22nd December, and was herself seized with it on the 25th, though she was able on this date to visit some friends having charge of a large school, still feeling very ill, and they assert that she was the cause of an outbreak there. On the 27th, although far from well, she visited the teacher spoken of, who was a great friend of hers, and this visit was returned on the 31st. On the 5th of January the teacher did

not feel well, and on the 6th was compelled to send for me. It may be as well to remark here that this teacher rallied quickly, and was well enough to go to her home on the 11th for two days, returning to her work much invigorated. On the 19th she was again seized with severe headache, catarrh, and rheumatic pains; indeed, all her former symptoms, and was again confined to her room for two or three days.

The first infants became ill on the 11th January, and these were two in the aforementioned teacher's class. As there was a great deal of pressure on the infirmary accommodation, it was thought advisable to treat the infants in one of their own dormitories, consequently one was set apart for this purpose. This dormitory was taken care of by two maids, one of whom, a rather delicate subject, was attacked on the 16th January. On the previous day two maids engaged in other dormitories had been laid up, and on the 18th and 19th two more teachers were compelled to leave their duty, both of whom suffered subsequently from severe bronchitis. The staff in the building are all resident, and consist of a matron, five female teachers, and thirty-two other officers and servants. With the exception of those before mentioned, only one other officer, the pantry man, the only resident male in the section, succumbed. He was taken ill on the 19th January. There are four senior boys sent from division 1 to assist him with his stores, and one of these was away from work on the 12th, a week previously. Between the 11th and 20th of January 125 infants were seized with the prevailing epidemic, the greatest number of cases occurring on the 14th. With one or two exceptions all rallied quickly, and after two days in bed, and a third in another dormitory, they were able to go into school again.

The matron of the probationary wards (division 3) was compelled to take to her bed on the 12th January. In this department, which is about 250 yards to the south of the last-named building, and on the confines of the manager's property, there are four senior boys, who attend to the gate and act as messengers between this and the other departments. They are half-timers. One of these boys was admitted to the infirmary on the 7th January, and there seems a direct connection between his illness and that of the matron. At this time there were three other officers and twenty children in the building, but none of these were affected. The infirmary is situate to the rear of division 1, with accommodation for about 200 children, and a staff of twenty nurses and servants. At the time of the epidemic

there were 120 patients, suffering for the most part from affections of the eye or skin. All of the junior and senior boys affected were treated here; but of the staff one only was attacked severely, two slightly, and all the ordinary patients escaped.

As I have before stated, the girls occupy separate buildings about 600 yards east of the Brighton Road Schools. This division, called for convenience No. 4, is on the block system, there being six houses accommodating 102 girls each, and severally presided over by a housekeeper and her assistant, together with a laundress for each house, and, in two instances only, a cook. The first case of which we have any note here is that of the housekeeper before mentioned in connection with the infant-school teacher, and on the 7th January a number of girls in her house were prevented from attending a distribution of toys in the central hall, as they were ill. I saw these cases on that day, but did not attach must importance to their symptoms. Next day I was compelled to send several of them to the infirmary. The affection spread generally and rapidly amongst the other children, and on the 8th January there were seventy-eight cases. Although the girls are divided into separate houses, yet during this time, owing to the severity of the weather, they were kept more constantly indoors, and generally congregated in one day-room. The numbers fell, but rose again on the 12th to thirty-nine, diminishing then, till the last case occurred on the 21st. The whole number of cases was 228, out of a total of 550 girls, or a proportion of one in two. There are forty-four indoor and seven outdoor officers connected with this division; and of these, four indoor and two outdoor were attacked, or a proportion of one in eight. It will thus be seen that while the proportion of girls attacked was much larger than in any of the other divisions, the proportion of adults was smaller. In division 1 the proportion of children was one in three; of adults, one in six. In division 2, of children, one in three; of adults, female all but one, one in six. In division 3 the proportion of children *nil;* of adults, one in four.

The symptoms as shown in the children were of a much milder character than those exhibited by the adults. To begin with the infants from four to eight, sickness and headache, with a certain amount of nervous depression, characterised all the cases. Ten of the junior boys, from eight to eleven, in addition to these symptoms, had rheumatic pains in legs and back, and four had catarrh. Then seven of the senior boys, eleven to sixteen, complained of

pains in limbs, etc., and twenty-four had catarrh, while only forty-three were sick, headache being the most prominent symptom. Of the girls, only one complained of pain other than headache, but several had pulmonary symptoms afterwards. The adults complained generally of a rigor in the first instance, and most of those treated by me had catarrh and the feeling of sickness without vomiting. Two or three had severe bronchial catarrh afterwards, but no other complications manifested themselves. The temperatures in the older children present well-defined curves. On comparing the charts of a number of cases, it will be seen, both in girls and boys, that it rose somewhat sharply at first, and then fell steadily. It was remarkable in some cases to find the temperature normal in the morning, rising rapidly during the course of the day, falling in the night, and regaining its normal position by the next morning. The infants started, in a great many cases, with a much higher temperature (as was to be expected) than the older children. This fell very rapidly on the second day; but generally on the morning of the third day, or perhaps later, there was a slight increase, but this was maintained only for a few hours.

The treatment in the case of the older children, from eight to sixteen, consisted, in the first instance, of a salient aperient, followed by frequent doses of quinine; but I soon found that those who vomited freely rallied quickest. I therefore tried emetics, which had a capital effect. In a few cases, especially among the girls, I found it necessary to give a few doses of antipyrin; and where rheumatic pains in the limbs were present, salicylate of soda, given frequently in small doses, rapidly gave relief.

I have to thank you, Sir Thomas Crawford, for the opportunity given me of bringing these few facts under the notice of this learned Society, and I hope that I have been able to show, first, that the disease in question is contagious; that it affects children, as a rule, in a mild degree without serious complications; and that in them the gastro-intestinal tract is principally involved. There was no sweating or rash. The period of incubation appears to me to vary from two to ten days, and, as far as I have seen, boys and girls appear equally susceptible.

ENTERIC FEVER IN INDIA: ITS INCREASE, CAUSES, REMEDIES, AND PROBABLE CONSEQUENCES.*

By ROBERT PRINGLE, M.D.Edin.; late Sanitary Department, N.W.P. India; Ret. Surgeon-Major, H.M.'s Bengal Army.

(*Read : May* 14*th*, 1890.)

In selecting the subject of this paper, in response to a request for a communication from the Epidemiological Society made to me by its President, Sir Thomas Crawford, M.D., K.C.B., late Director-General of the Army Medical Department, it may not be out of place to state here that it originated from the facts recorded by the President in his inaugural address to this Society, delivered at the opening of the Session, "On the Prevalence of certain Zymotic Diseases in the Army in 1887," and particularly with reference to that of enteric fever in India.

1st. *The Increase of Enteric Fever.*—Before proceeding to discuss this point, it will be necessary to satisfactorily prove that this increase (generally admitted as it is) is real, and not imaginary, *i.e.*, is established by incontestable data to be such; or, on the other hand, is mainly due to carelessness or ignorance in nomenclature, by which, that which is recorded as enteric fever is, in the majority of cases, malarial fever of a continued type, occurring among young soldiers, it may be even late arrivals, and due in a great measure to excesses in diet and alcoholic stimulation, together with the proverbial carelessless, nay thoughtlessness, of youth, inducing conditions highly conducive to the worst type of malarial fever, which in many cases might justly be termed typho-malarial. The real importance of clear data on this point is such that I would draw attention to a remarkable report issued by the Sanitary Department of India on this increase of enteric

* "To abolish disease, not by curing it, but by preventing it, was, in his (Sir William Gull's) opinion, the end and aim of the physician, and to know and counteract the causes of disease before they became effective was evidently the triumph of our art."—*The late Sir William Gull, M.D., Bart.*

The late Chaplain-General Gleig, formerly a military officer, at probably the last meeting he ever attended, the great Church Congress, uttered the following memorable words:—"Never let us forget what we owe to the soldier whom we have lured from his home."

fever, in which it would seem that this increase is stated to be mainly due to faulty diagnosis of the disease, and, as a whole, reflecting most seriously on the professional skill of the medical officers at large military stations such as Meerut and Lucknow.

Now, it is difficult to understand how, in the station-hospitals at these large military cantonments, all the medical staff attached to them should be so far mistaken in their diagnosis as to make it possible for considerable numbers of cases of fever to be recorded as enteric, when in reality they were only severe cases of continued malarial fever. Though I have not as yet (April 1890) seen this report, it has been reviewed in a remarkable leading article, entitled "The Confusion of Fevers", in the acknowledged principal paper in India, *The Pioneer*, which in its issue of the 2nd April 1890, on the report in question, drawn up by this Special Commission, composed of the following sanitary officers, Sir Benjamin Simpson, Drs. W. H. Thomson, J. Richardson, and D. Cunningham, appointed to inquire into the alleged increase of enteric fever, states the following:—"There is", so write these medical officers, "a prevalent tendency to assume that the diagnosis of a case of fever, as of specific enteric nature, may be safely founded on a mere inspection of a temperature chart, and even that unrecorded prevalence of the disease may be detected by means of the study of death rates"; and, again, "a prevalent tendency to assume on insufficient grounds that other forms of fever of the type ordinarily described as remittent or simple continued fevers hardly exist."

Well may the writer of the leading article in question, with reference to these statements, remark: "This is certainly a strange commentary on the methods of a body of professedly scientific men, but it is the deliberate opinion of medical experts on their own profession, and on that account is presumably neither malicious nor biassed."

But who are these "medical experts"? The successors in a department which, ever since its inauguration in 1865, has revelled in theory, and been almost an utter stranger to practice—*vide* the wave of cholera, which, acquiring irresistible force at Hurdwar in 1879, swept up to the north-west, and was the direct cause of "the March of Death", so disastrous to the troops engaged in the late Afghan campaign; and yet all this, as I am prepared to prove, was due to the action of a single individual in this department, who, ignoring the experience acquired during the Khoomb *mala* at Hurdwar in 1867, and who actually witnessed the cholera

cloud gathering in the next twelfth year festival in 1879—exact to the day it began in 1867, believing in his own theory of cholera prevalence, took no steps to stop the fair at Hurdwar, though warned of the risk incurred, thus originating a cholera wave which I, as sanitary officer of the circle, know to have been the centre of one of the most appalling epidemics of cholera which have occurred in the memory of man in these Provinces.

I enter into these details, because, in the special sanitary report under notice, we have, it would seem, another most remarkable instance of Headquarters departmental statistical general theory, as opposed to local practical knowledge of the highest professional character, and as it has such an important bearing on the subject of this paper, I offer no apology for alluding to it in detail. The following, therefore, is from the leading article in question, the writer himself, no doubt, having been carried away by the specious arguments of the "medical experts" of the Sanitary Department of India:—

"A consideration of actual statistics, which all who run may read, leads to a similar conclusion." I here quote from the leading article, viz., "that doctors in India have for the last ten years been inventing enteric cases out of their own imagination." Here are these statistics:—"In December 1888, and January 1889, fever was very prevalent among the garrisons at Lucknow and Meerut; but while all the fifty recorded cases at Lucknow were set down as enteric, only thirteen out of fifty-one were so classed at Meerut. Now, remembering that the two garrisons were practically of equal numerical strength, and that the mortality was practically equal—six deaths in one and five in the other—we have a very strong presumption that the difference in classification represents difference in local opinion rather than difference in local fact." So much for the reviewer, and now for the Commission. "We have two bodies of troops of almost identical numbers, and under fairly parallel conditions, during one and the same period, yielding practically identical results as regards prevalence of, and mortality from, fever, and the fact that in one station the fever is recorded as one of the species only, and in the other as belonging to two distinct species, can only be regarded as mainly due to a difference of opinion. There are no means of deciding definitely in favour of one opinion rather than the other, but it appears not improbable that we have to deal with error in both cases alike." Need we wonder after this, that this reviewer adds as a corollary to the preceding the

following scathing allusions to the Army Medical Department:—"There surely was never a more candid confession of helplessness, or one more calculated to weaken the confidence of the public in the medical profession."

Now, the "medical expert" who finds any conceivable similarity between the physical conditions of Meerut and Lucknow, as inducing a tendency to febrile attacks, or can call them "fairly parallel conditions", no matter how similar the strength of the garrisons at these military stations may be, betrays, in my opinion, an ignorance of the local physical conditions bearing on the question of malarial (I prefer that term to "remittent" and "continued") as opposed to enteric fever in these two stations, which must put him out of court at once. Further than this, I am prepared to demonstrate that, on these local grounds of difference alone, the probable absolute correctness of the diagnosis of these medical officers at Meerut, in deciding that only thirteen out of fifty-one cases of fever were enteric, is only equalled by the probably equally correct record that all the fifty cases at Lucknow were truly enteric. Under the head of *local physical conditions* in Meerut, I would include the disgraceful ranges of barracks for the European troops to the east of the cantonments, many on a level with the ground, some almost below it, if judged by the effects produced by heavy downpours, while others (those for the Artillery) are actually known as the starting-points of cholera epidemics!

As regards the officers' quarters in this station, many, on the point of well-water, and the servants' latrine arrangements, are a disgrace to sanitation. I have seen in some cases these wells, owing to their proximity to the latrine, after heavy showers of rain converted into cesspools by means of rat-holes and roots of trees!

There is no large military station in India that I have ever seen in which the local physical conditions are more favourable to the worst type of malarial fever than Meerut, and few, I think, from the necessary defect in the fall in the drainage, and the sources of the water-supply, though with superior modern barracks as compared with those at Meerut, more favourable to enteric fever than Lucknow; and yet it is in drawing up careful diagnoses of fevers in dissimilar stations such as these that medical officers in the army, if rank and promotion are anything else than a travesty, are charged by these so-called "medical experts" with suffering from the "prevalent tendency to assume that the diagnosis of a case of fever as of specific enteric nature may be safely founded on a mere inspection of a temperature chart, and even that

unrecorded prevalence of the disease may be detected by means of the study of death-rates."

Really, it is not easy to write calmly of such remarks, which tempt the writer of the leader in a first-class unprofessional paper to say that "the murder is out now; it is openly admitted that in the diagnosis of serious fever cases the doctors are all at sea. Will the profession be content to remain under this unpleasant imputation? If so, it is high time Government took the matter up, and appointed a committee of investigation, which should inquire exhaustively into the character of Indian fevers, and endeavour to establish some scientific basis for their accurate diagnosis."

Instead of appointing a committee for this purpose, let the Government search up its records and find out how it is that a Sanitary Department has, during the past twenty-five years, without one word of remonstrance or even warning, allowed the Canal Department of the North-West Provinces to convert, by a system of inundation, falsely called irrigation, a luxuriant garden of healthy agriculture into a charnel-house, with grass in the beds of choked-up rivers so rank that buffaloes refuse it, and ground in patches of hundreds of acres so cold and damp, that even sugar-cane will only grow as rushes! Worse than all this, this Sanitary Department, by its apathy and indifference, has allowed this Canal Department to extend its *pestiferous waters* into the Deobun Doab against the wishes of the people, who had too visible evidences of the fatal effects of this inundation in the west in the Saharanpur, and the east in the Muzuffurnugar and Meerut districts. The same has been done in the Muttra and Agra districts, though at Futtehpur-Sicri, near Agra, are the remains of irrigation works, abandoned on account of the outbreaks of fever they produced, attacking the Royal city of Agra, evincing in a remarkable degree the prescience of the then rulers of Northern India. So specially susceptible is the military cantonment of Meerut to outbreaks of the most extensive and fatal type of malarial fever, that I have known the digging out of a foundation for buildings in the Meerut jail, not far from the cholera-starting barracks in question, the direct cause of appalling outbreaks of this type of fever, due entirely to the depth of the excavations cutting through a thin layer of impervious *kunkur*, and thus liberating the pestiferous, malarial gases pent up in the subterranean lakes lying under this deposit.

But I must pass on to

2nd. *The Causes of this Increase of Enteric Fever.*—These may be summed up in defective or polluted water-supply. I

am quite aware that in most cases the age of the soldiers now arriving in India is stated to be the chief reason of this increase of enteric fever. This is certainly a strange line of argument for a Sanitary Department to advance, because this defective or impure water-supply furnished sources of disease which the period of youth has a special facility and susceptibility of taking up and developing into that train of symptoms witnessed in enteric fever; and therefore to describe this condition of youth as a general, and direct cause of enteric fever would be much like saying that unvaccinated children, because they are children, are specially susceptible to the contagion of variola, and that by bringing them into a locality where vaccination is discarded or neglected it would be correct to say their youth was a cause of their suffering from variola, whereas it was in reality the persistent or gross neglect of the sanitary precaution of vaccination. British military occupation of most localities in India is certain to lead (the rapidity depending greatly on local physical conditions) to the pollution of the soil, and hence to the spread, if not the origination, of enteric fever, unless the purity of the water-supply is protected and secured, and I unhesitatingly state, as one who has known the locality better than any other medical officer, that in the Agra and Meerut division, or the first circle of sanitation in the North-West Provinces, for the twenty years following 1864, not only was nothing done either to scientifically obtain or secure the protection of this necessary of health, but during these long years it would seem that everything which would tend to originate or increase its impurity has been allowed to exist, and continue; and hence an increase of enteric fever is simply a natural sequence of this wilful neglect of the first law of sanitation, viz., the procuring and securing of a good water-supply.

I am fully aware that these are very serious charges to make against any department, and particularly the Sanitary Department, and that by one, the last twenty years of whose service was spent in it, but I have public documents and records to support this charge. A quarter of a century ago (1865), while I was in the Vaccine Department, and resident at Mussoorie, in the Himalayas, I wrote to Sir William Muir, K.C.I.S., then Lieutenant-Governor of the North-West Provinces (there being no Sanitary Department then), and pointed out that unless prompt and effective measures were taken to obtain a good water-supply, and maintain its purity, the important hill sanatorium of Mussoorie would, from its special local conditions and altitude (5,500 to 6,500 feet

above sea level), become a hot-bed of typhoid, if not typhus fever. In this year (1865) I was called in to treat a case of undoubted typhoid fever, solely due to the impurity of the water-supply of that part of the sanatorium. My fears were more than realised next year; and then I felt the importance of prompt and effective action, and for this purpose I soon after sought election on the Municipality of Mussoorie, and was ultimately elected by a popular vote, and not an official nomination. The first attempt I made was with the water-supply at Barlowgunge, close to my house. The complete success of this scheme led to that known as the Chalmers Khud water-supply, and finally to that from the west side of the Landour hill. Ere I left Mussoorie in 1883 all three water-supplies were in full working order, and Mussoorie could boast of a water-supply from these three sources, which, combined, make it unequalled by that of any station in India. The entire cost of this first necessity of sanitation was under 30,000 rupees, spread over some years, and effected without the addition of an anna to the local taxation. This supply is not only constant, and in the centre of the sanatorium deliverable at a great height, but is *absolutely beyond the reach of pollution.* The Sanitary Department of India had nothing to do with this, and to the municipality of Mussoorie is due the entire credit of exhibiting to the municipalities of the sanatoria of India what can be done to promote public health, and literally to carry out the motto of this paper, *in preventing the disease, and counteracting the causes before they became effective.* The reasons for my entering into these details will be evident when I come to allude to the neglect of these precautions in Murree, Chuckrata, and Raneekhet, and the consequences which have followed. Much is said regarding the susceptibility to enteric fever in the case of the young soldiers, and undoubtedly with great truth; and therefore, unless measures were taken to secure a good water-supply, we should expect to find this enteric prevalence in the large schools of the Himalayas, but, speaking for Mussoorie, where there are probably as many schools as at any hill sanatorium in India, I know such is not the case. One school in particular, for the sons of the poor Europeans in the plains of India, occurs to me, where the care of the boys is entrusted to men nurses, yet here, thanks to the pure water-supply obtained from Barlowgunge, I have never known in twenty years a single case of this enteric fever. The first case of this fever I saw in Mussoorie was that of a girl at a small private school. The impure drinking-water brought from a spring on the hill-

side below the school, into which some surface drainage found its way, was clearly the cause of the disease in this case; while in another case it was due to a draught of impure drinking-water partaken of at one of the public institutions of the sanatorium, where the water was undoubtedly impure, and was obtained under similar conditions to the other case. Both cases were of girls of about fourteen years of age, and, though both recovered, it was after a long and tedious convalescence.

Let me compare with the water-supply of Mussoorie that of the large Military Hill Sanatorium of Chuckrata, about forty miles from Mussoorie. I can remember the site of this station before there was any idea of selecting it for one of the most remarkable, as regards expenditure and cost of maintenance, of all the military sanatoria in the Himalayas, and it had absolutely nothing to recommend it except a magnificent water-supply 1,000 feet above the highest point of the site. Against it, was its distance from the plains, and consequent enormous expense of carriage; the faulty character of the soil as regards its capability of becoming polluted; the position of the sanatorium with reference to *the trade wind* from the plains in the day and the snows at night, the station generally lying nearly north and south, instead of due east and west; the scarcity of fire-wood, and the height necessitating fires for many months in the year, until, at last, this latter defect drove the regiment to the plains to avoid the cold due to the scarcity of fire-wood. Now, would it be credited that this perfect water-supply was, for all practical purposes, next to useless, and the drinking-water was taken from a source so manifestly liable to pollution that a walk down the hill-side revealed the certainty of these impurities finding their way *unchanged* into the drinking water-supply beneath. The point at which this water was collected in tanks being the apex of two converging *strata of rock*, while at the top of this surface drainage (for the rocks make it only practically such) is a large occupied barrack, and all the impurities thrown out to the south-west of this barrack must find their way into the collected drainage water beneath, used for drinking purposes without any local filtration or purification between its collection and its removal in the water-bags on the mules. It was not long ere this manifestly defective and impure water-supply produced results easily explained, and it requires no detailed description to demonstrate the fact that all that is necessary for an outbreak of enteric fever is the pollution of the water with the specific poison of a single

case. Year after year I drew attention to this defective state of the water-supply, and once, while in Simla, called on the Quartermaster-General of the Army, and undertook, for the 40,000 rupees paid annually for the mule carriage of water, to bring into the station, to the highest point, an ample supply of not only pure, but unpollutable, water, and instanced in proof of the feasibility of my proposal the success of the water-scheme at Mussoorie, known as the Barlowgunge water-supply. But all to no purpose. It could not be carried out, and the troops continued to drink to an alarming extent what was little better than surface drainage. On the failure of this proposition, with the view of saving the mules, so as to admit of their bringing some drinking-water from a better supply further off, I drew out a scheme for the collection of the rain-water from the galvanised iron roofs, as I had practised at Mussoorie; but this was not even taken notice of, and a splendid piece of engineering skill (!) for allowing this wonderfully pure rain-water to run to waste down the hill-side, was persevered with till I left India in 1883!

All this may seem incredible, but anything is possible in India, as the following will show. The same Military Hill Sanatorium of Chuckrata had for many years a notorious character for the prevalence of venereal diseases, but, as this special subject did not come under my supervision, I had no reason in previous years to inquire into it. Shortly before leaving India, however, I had occasion to have this subject, in the working of the C. D. Acts, brought under my notice in connection with the Civil Hospital at the station, where I was assisting the medical officer in performing an operation, and the result of my inquiries into the practice of the C. D. Acts at this station was such, that I summed up the report I felt in duty bound to submit by stating *it were hard to say whether sanitation or decency were most outraged in the way in which these Acts were carried out in this Military Hill Sanatorium.* For ten years this system had been in practice, and had the question been asked, To what was the prevalence of venereal disease due? no doubt the answer would have been—to youth, over-stimulating diet, excessive indulgence in alcoholic stimulants, and idleness; whereas, if I may judge from what I saw and heard, I should certainly say it was due, in a very great measure, to the defective manner in which these Acts were carried out: not that, practised in any way, they can, in my opinion, ever produce good results, but here they have for years been actually not only pro-

ducing, but continuing one of the two diseases, the prevention of which was the object aimed at by these very Acts!

This instance corresponds with the origin of the true cause of this increase of enteric fever, as both diseases under these conditions are due to gross and continued violation of well-established natural laws, which are and have been guarded by clear and well-defined lines of action, and if we follow it out in the case of enteric fever we shall doubtless arrive at the following conclusions. Enteric fever, as a rule, begins with a given case of the disease, which, owing to its practically, as yet, unfixed period of incubation, it is difficult to trace back, without failure, to that case which produced the specific enteric virus, but which, finding its way by a fluid medium into the system, lighted up the disease under observation. For instance, the water in foul wells, as I know, on the line of march will originate in a cantonment many marches away an outbreak of enteric fever under certain conditions, and yet the case, or the local cause which originated the one under observation cannot possibly be traced. What, therefore, is necessary, as all will readily admit, is measures to prevent the germs of this case, imported into the cantonments, from continuing the disease; and it is here the whole point of this paper lies, viz., Are the physical conditions of an Indian cantonment, as regards the drinking water-supply, speaking generally, such as to reduce to a minimum the risk of the propagation and dissemination of the virus? I unhesitatingly state that, speaking for the Agra and Meerut military divisions, I know of no special measures by which the prevention of this propagation and dissemination may be secured, and, alas! too many where these contingencies are actually favoured.* For instance, what steps are taken to secure the purity of the water in the wells in camping grounds on the line of march? what steps to secure the purity of the water at the railway-stations, or the large and favourite wells in military cantonments, such as the "Meeta Kooah", or *Sweet Well*, at Agra, etc.? But as I must allude to this again under the head of Remedies, I will not enter further into details here.

During the past year, in the instance of the chief town of one of the Border counties in Scotland, *a single case of enteric fever*, occurring in a house on the banks of a large mill-dam, was the direct cause of an outbreak of this fever in the town *above* the mill-dam, which only an entire revolution in the system of obtaining the water-supply

* *Vide* the water-supply of the Landour Military Convalescent Depôt in the Himalayas till 1882.

checked at the time, and will prevent the recurrence of. I was consulted in this case, and had there not been the most conclusive evidence that this single case was the true cause of the outbreak, it would have been hard to believe that in the vast body of water in this mill-dam it could have been possible to have pumped up to the reservoir at the head of the town, even from a well sunk in the bed of the river, but situated *below* this mill-dam, that portion of the water containing the germs of this terrible disease. But *the germs of one case* found their way into this well, or rather hole in the bank of the river, by means of the mill-dam, either through some defects in the pipe-drainage of the town or the surface drainage from it, and then by a simple repetition of this pumping process the epidemic was disseminated till its prevalence attracted attention, and then the water was drawn from the river higher up, with the result of checking the outbreak.

If I appear to write strongly on this point it is because, with my knowledge of the British soldier in India, I am quite satisfied that these cases of enteric fever are not confined by any means either to the late youthful arrivals or to intemperance and excesses, but are met with among young soldiers of excellent character, careful total abstainers, who are the most unlikely men to produce in their constitutions a special susceptibility to contract enteric or any other fever by thoughtless exposure to the night air or excesses in eating or drinking—biliary derangement from the former and alcoholic stimulation from the latter too frequently resulting in conditions peculiarly favourable to the absorption of the true enteric virus. Young soldiers *must* go to India, even though "lured", as the late Chaplain-General pointed out; and the aim of all sanitation *should* therefore be to produce a condition of local surroundings *least favourable* either to the development—I use this word advisedly—or the spread of enteric fever. The type of the British soldier in India has changed in a most marked manner for the better during the past twenty years, and I can positively affirm that the increased value of his life is due entirely to moral, not physical, sanitation. The theory, therefore, which places almost the entire responsibility for susceptibility to enteric fever on the youth, excesses, and thoughtlessness of the soldier, when the water-supply is in the disgraceful state it is now in, is despicable as regards sanitation, and criminal as it relates to the great aim of all medical science, which should be the prevention of disease rather than its cure; and, in selecting as the motto of this paper the words of the late

Sir William Gull, I feel I am not attempting to soar too high when I plead for physical sanitation to be the handmaid of moral sanitation.

In discussing the third division of this paper, viz., *The Remedies for this Increase of Enteric Fever*, I shall have to enter a little more fully into the defects which are the true causes of this increase. In 1864, when travelling through the Agra and Meerut divisions, with over 300 miles of the Grand Trunk road in my sanitary circle, I felt the great importance of securing pure water in the road-side wells, or the "Koos Kooahs", *i.e.*, two-mile wells, from their being situated at this distance apart on alternate sides of the road where practicable. There are 500 of these wells in the 1,000 miles of road, sunk at a cost of 100,000 rupees, the gift of a Hindu gentleman for his water-drinking countrymen. In addition to these wells, there were those on the encamping grounds, and, after various efforts, I succeeded in perfecting a plan by which not only pure water was procured, but it was also secured in this state, the chief point of which was to arrange so that the water in these wells was being regularly withdrawn for irrigation purposes, thus securing a regular admission, and further, by marking or closing wells the water of which was *incapable* of being purified, preventing them being used for drinking purposes. The whole plan was drawn out, and so arranged that it would not have cost the Government a penny, and submitted to the Government through the Sanitary Department, and my reward was a hint that my duties related to vaccination, not sanitation! Some district civil officers, however, notably one, was so impressed with the scheme that he had it put in practice at once, and when, years after, the question of the purity of the water in the wells in encamping grounds *dawned* on the Sanitary Department with the Government of India (!) my principle was found in working order; but even then, I regret to say, it has not by any means been generally adopted, and the present mode of cleaning wells in these encamping grounds is to draw out the water before the troops arrive, a practice which too often secures the distribution of the impurities in the well adhering to the sides, among the troops when, fatigued and thirsty, they arrive on the camping-ground after a long march. Can it be a matter of surprise, therefore, that, as mentioned before, the germs of many of these cases of enteric fever are received into the system from the impure water in these wells, and taken to large cantonments, where gross defects in the drinking water-supply soon aid in propagating the disease,

and we then hear, as our President pointed out in his inaugural address at page 10, that "in no case was the disease satisfactorily accounted for", and this at Lucknow; while at Faizabad "the disease could not be traced directly to any local insanitary condition". I believe there is nothing more likely to lead to the most fatal types of fever than drinking the water of unused, or even too little used, wells in India; and if there were any doubts about the frequent change of the water in any well, and no other water was available, it is advisable invariably to boil the water, and in the process of cooling allow it to be reaerated by pouring it from a height from one open-mouthed vessel into another. The case of the fatal type of malarial fever at Haupper, alluded to hereafter, was entirely due to the use of water from wells but very little used, owing to *caste* and other prejudices. The way in which the "coffee-shop halts" on the line of march are often made lead to considerable risk in the case of drinking-water, though, of course, the water used in the tea or coffee, from having been boiled, is safe. Soldiers should be warned against drinking the water of road-side wells at all; and, as a rule, the water taken from a constantly used well, such as one used for irrigation, is generally the best, *but only when at a distance from a village.* So important is this point in the *apparent unknowable* way in which enteric fever originates and spreads that I fear, if the natives were as susceptible to the disease, and suffered from it as Europeans do, India would have been uninhabitable for Europeans; but the natives of India rarely suffer from enteric fever as such. I have seen them dying from a fever of appalling prevalence and mortality in 1879, when, in the four districts of Meerut, Boolandshur, Alighur, and Etah, with a united population of over four millions, in a few months this fever carried off half-a-million of human beings, while the number of pregnant women who miscarried, or were prematurely confined, was such as to most seriously affect the birth-rate, and yet, in this epidemic, I could not say there were any truly enteric symptoms. The constitution and habits of a native of India are not such as to supply the fuel for an attack of enteric fever. They generally die in the early stages, ere true enteric symptoms are developed; while, if the struggle is prolonged, the natural colour of the skin greatly interferes with the diagnosis of any otherwise characteristic eruption.

Time will not admit of my alluding in detail to other causes of this increase of enteric fever with reference to their remedies, but, outside of cantonments, undoubtedly the

milk-supply must, in a certain measure, be a source of conveying enteric poison, though certainly not to the extent met with in this country, as enteric fever, as I have pointed out, is rare among the native population, but, in addition to this, most of the milk brought into cantonments for public use is *boiled in India before being exposed for sale.* But what we are chiefly concerned with is the pollution of wells under military supervision in cantonments, and the civil authorities in towns and railway-stations. Let anyone watch the dirty *lotahs* (brass drinking-vessels), constantly being dipped into such wells as the Meeta Kooah (the Sweet Well) at Agra, or those at railway-stations, such as Toondlah, Alighur, Gazeeabad, and Saharanpur, all in my late sanitary circle; or carefully inspect the water in the filters at rest camps and barracks, and we shall cease to wonder how the worst types of malarial fever arise and spread, and produce, it may be, in individual cases conditions eminently susceptible to the influence of the enteric poison, when one case is all that is necessary, under the favouring circumstances at hand, to start an epidemic. I saw the water in the upper part of the filter at the Meerut cantonment railway-station in a condition which only required a regimental band to convert the station into an aquarium! The drinking water-supply at railway-stations in India, thanks to the wise forethought of that Solon of Indian Viceroys, the late Lord Dalhousie, should be perfect; but, alas! it is too often the means of spreading disease. After, the Hurdwar fair in 1879, with cholera raging at Saharanpur, the *lotahs* dipped into the well at the railway-station must have too often been fouled with *unutterable impurities*, as anyone could see for themselves who have watched the *lotah*, this indispensable drinking-vessel of every traveller in India hanging over his shoulder, and resting, when he sat down, *on the ground covered with the impurities of the dead and the dying.* To obviate the possibility of this contamination, I suggested that all railway-station wells at large stations like Saharanpur should be covered, and hand-pumps be attached to them, or, better still, that when the water was being daily, often twice or oftener, drawn up to the tanks from which the engines are supplied, a simple arrangement be made by which tanks for drinking-water could be filled, and the water drawn off by taps below.

I have found this practicable at Mussoorie, where hundreds of all castes use such taps daily. As far as I am aware, nothing under this head has been done since I left India, and no practical notice whatever was taken of my sugges-

tion at the time. Lord Dalhousie's order was that at every railway-station in India free water for drinking should be available from the hands of a Hindu and Mahomedhan for every applicant in the train: and what easier plan could be devised than this? No one can have studied this subject of the water-supply in India without being struck with the utter absence of any protective measures to secure its purity. Uncovered wells, with a consequent deep stratum of leaf-mould, the home or *cultivating media* of malarial germs, through which the incoming water is forced by the spring power, must surely account for the terrible increase of fever in many stations, while the raising of the water-level, due to the inundating water of canal irrigation, with defective masonry sides, with rat-holes and roots of trees, make too many wells in the rains little else than cesspools, no water having any chance of being filtered through the soil and forced up through the tube of the well from the bottom.

To remove this leaf-mould at the foot of the wells in cantonments, in conversation with Mr. Bull I suggested a plan by which a Bull's dredger, placed on wheels, with a temporary set of shears for working it, could be used in a group of stations, and transported by bullocks or horses from one station to another, in much the same way that a portable engine is made available in this country, but no notice whatever was taken of the suggestion, and I have no doubt an examination of the wells in most Indian cantonments, and particularly at Lucknow, would reveal conditions of insanitation which would raise the question, not why so many die of fever, but how is it that any escape.

There is, perhaps, no greater source of danger to the purity of the water in the wells than the roots of trees, as along these roots the surface drainage often passes pure and simple into the well, and is drawn up by the *lotahs*, and greedily drunk by the thirsty passer-by; and, though I have no desire to be a prophet of alarm, I feel confident, as I pointed out to Sir Joseph Bazalgette a year ago, that the system of tree avenues in streets is one calculated, at no distant date, seriously to interfere with the network of pipes under the roadway; and, if I may judge by what I saw in the case of a water-pipe, the consequences, if this leak takes place in a sewage-pipe, must be most serious, and may explain what I witnessed in the Health Exhibition of 1884, when an Artesian tube-well, brought up, from a depth of twenty-two feet below the floor of the building, in a stall close to my own exhibit, *water which was distinctly contaminated with sewage.* In the case of the water-pipe, alluded

to before, it was discovered by a remarkable passage of water through the meter, where there was little or no withdrawal of it by the pipes in the house. On the pipe being exposed to the meter, it was satisfactorily accounted for by the root of a tree passing under the pipe, and bending it till a large leak occurred. When the wind was blowing strongly from a certain quarter the leakage was very great, by the strain on the pipe widening the leak, but at other times not so much. The soil, however, around, although gravelly, was very damp, fully explaining the increase in the water-bill. If for this water-pipe we suppose a sewage-pipe to be thus acted on by the root of a tree, a condition of hidden insanitation is likely to arise, which may account for some of the late severe outbreaks of typhoid fever where the social position of the residents would apparently preclude the possibility of such occurring.

During the prevalence of the severe and fatal type of malarial fever at Haupper, in the Meerut district, alluded to before, I made a careful investigation into the causes of it, as the outbreak occurred among the upper classes and wealthy residents of the town. I clearly traced this outbreak to the use of water from very partially-used wells—a too normal condition, I fear, of most of the well-water in encamping grounds, due entirely to the neglect of the authorities in carrying out my system, by which these wells would have been used for irrigation purposes, and thus the supply in them would have been kept pure and fresh. In addition to the impurity of the water from its being so little withdrawn, the wells within the enclosures of many wealthy natives' residences are often much too near a terrible institution called a "chawbăcha", which, from the character of its contents, is little else than a cesspool, and it is placed too often *under the verandah*, where the residents sit! One of the aims of my suggestion with reference to the wells in encamping grounds was to adopt measures to prevent the possibility of the present foul quagmires which surround many of these wells existing, as the water from them, in many cases, must pass into the well, and remains on the surface for the first passer-by to raise in his *lotah*.

The best preventive, however, against the risk inseparable from using well-water in the East for drinking purposes is, I repeat, boiling the water. I invariably practised this; and I do not think any officer in India, during the last twenty years of his service, had ever cause to vary this source of his water-supply more than I had, for, out of the twelve months in each of these years, I was more than half of them in

camp. I always had my drinking-water drawn from a constantly-used well *at a distance from a village*, and, if I had any suspicion, the water was always boiled, and reaerated by being poured from a height for cooling purposes from one vessel into another.

To show the terrible risks the British soldier in India runs from drinking even a harmless beverage like soda-water or "pop", I may mention here what came under my own observation as sanitary officer at Landour, in the Himalayas. At the Himalaya Club at Mussoorie, on the occasion of the celebration of the Queen's birthday some years ago, it was found that the champagne cup had a *peculiar flavour*, but, as the champagne was Mumm's best, it could not be due to it. When, however, as a teetotaller, I inquired into the ingredients of the "cup", I found the fault lay in the soda-water used in this beverage, which had evidently been made from water obtained from a grossly polluted source, and which *must have been* little better than the surface-drainage of a very impure hill-side. When I mentioned this to the seller of this soda-water, a Mahomedhan, and owner of one of the best shops in the station, his answer was very characteristic: "An enemy has done this to get me into trouble."

All wells in military cantonments at all likely to be used by the troops should be under careful supervision, and, as I have repeatedly suggested in my annual reports, they should be covered to protect them from the leaves; indeed, once this was done in the case of Meerut, but I lived to see the covers all fall to pieces, and they were not renewed. In addition to this, I pointed out the importance of periodically having the wells cleaned with a Bull's dredger, as described before.

Since the preceding was written, I have seen the report of the Special Commission into the increase of enteric fever, and note the particular stress laid on the number of officers attacked with this fever, and perhaps the following may help to account for this, and also point out the type of the fever as met with in Meerut. In my opinion, one of the most fertile sources of malarial fever, from the mild remittent type, which readily yields to proper remedies and precautions, to the severest form of continued fever, which, without doubt, produces a condition eminently favourable to the admission and absorption of enteric poison in the case of officers and civilians, is the modern game of lawn-tennis. This game is but a modern mode of exercise, and, unless indulged in with care, is, under the too frequent circumstances in which it is engaged, a peculiarly dangerous

one to the health. Take the lawn-tennis grounds at Meerut, Delhi, Agra, and Lucknow, look at the green velvet grass, what does that imply, even in the cold weather, but super-saturation of the ground, with a consequent *lowering of the temperature* immediately the sun sets. The bodies of the most energetic players are very much overheated, and in this state a whiskey or brandy *peg* is not unfrequently indulged in (tea or coffee being too heating!), thus increasing the susceptibility to the injurious effects of a chill, owing to the depression invariably following the exaltation of alcoholic stimulation.

The player, instead of cooling down slowly, sits still, with insufficient wraps, and engages often in earnest conversation, until he starts up with, "I must be off; I feel chilly, and want a walk." But it is too late. Unless he is now careful, and is in good health, he will be on the sick-list next day with fever, and soon the report will be abroad: so and so has got "a go of typhoid". I have two such cases at Meerut before me now, both officers in excellent health, but they got a chill as I have described, and went on the sick-list. They had nice dishes of jelly and other suitable articles of diet sent to them, and ultimately both made good recoveries. Now, the place and mode of convalescence in these cases were quite characteristic of the type of the fever from which they suffered. In one case the convalescence was spent in organising a pig-sticking expedition in the "Kader", or dry-bed of the Ganges; and, in the other, in leading a tiger-hunting party in the jungles of the Dehra Dhoon, North-West Provinces. Now, as I pointed out at the time, in a letter of warning I wrote to the papers, had these officers only taken as good care of themselves as they invariably do of their polo ponies, they would never have gone on the sick-list. Those of us who knew India thirty or more years ago can remember, *in the hot weather only*, the games of rackets and the bath after, but no sitting, as now, in the chill of a winter evening in the North-West Provinces, on damp grass, with clothes saturated with perspiration, engaged in earnest conversation, and the temperature quickly being lowered all the time. No game calling for such violent exercise as lawn-tennis demands was, under similar conditions, thought of thirty years ago, and, with all the carelessness of those days, rackets were not played in the cold season as a regular game, as it was in the hot weather. Now, all is changed, and therefore there need be little surprise if, with this violent exertion under the most unfavourable conditions to resist fever, and the most

favourable to receive it, there is an increase of fever among the officers, and mortality in those cases of chronic biliary derangement from dysentery and abscess of the liver.

I will now conclude with the fourth division, viz., *The Probable Consequences of this Increase of Enteric Fever.*

These, I consider, are most serious, and the Hill Sanatorium of Murree, in the Himalayas, is a terrible instance of persistent neglect of sanitation, and the indifference and apathy shown in the matter of the water-supply. The large Hill Sanatorium of Ranee-Khet, also in the Himalayas, will soon rival Murree, and nothing but the greatest care will keep Chuckrata from following suit, for I know the peculiar suitability of the soil to receive and cultivate the enteric poison, and of the *then* water-supply to disseminate it when once it has secured a footing. No outlay should be spared to secure a good water-supply, especially in Hill Sanatoria, and the lessons learnt at Chuckrata should be a warning to the authorities. Here we have a station on which money was spent without stint in a most reckless manner, as I know; indeed, the station was laid out, barracks built, and roads made, as if the days of Budgets had not dawned on the crippled finances of India, and now the dark cloud of enteric fever hangs over it, ready, under the favouring conditions at hand, to burst out in a fatal epidemic, which may end in a permanent possession of the locality by the enteric poison, as Murree appears to possess that of cholera. This cloud at Chuckrata can only be removed, and the consequent risk of this enteric possession of the locality prevented, by the most scrupulous attention to physical sanitation, as the only means of preventing the pollution of the small streams in the valleys by means of surface-drainage of the *European occupied hill-sides* above. And why is this the case? Because proper attention was not paid to the water-supply *at first*, and cases of cholera have occurred at Chuckrata at an altitude I have not met with in the Himalayas before: not that I would wish it to be inferred from this that cholera at this altitude is solely dependent on defective water-supply, but merely that there were present at this Hill Sanatorium those conditions which favour the development of cholera, without the possibility of the infection having been contracted in the plains of India, as was the invariable case at Mussoorie, as I know, during the twenty years from 1864, *when in every case of cholera* at that civil station, or the adjoining military one at Landour, the infection was traced to the plains within thirty hours. I can

remember the military station of Roorkee as one of the most healthy stations in the North-West Provinces, but now this seems changed, and continued *European military occupation* of this locality has, I fear, through the neglect of sanitation in the matter of the purity of the water-supply, and its protection from contamination, resulted in conditions which have produced an increase of fever of a fatal type, by whatever name it may be called, which must go on increasing unless prompt and energetic measures are adopted, till, like Kurnal of old, the mortality may prove such that its absolute abandonment may be decided on. The extension of the canal irrigation, or rather inundation, in the Muttra and Agra districts, is producing a terrible increase of fever among the European troops there, and doubtless, ere long, some "medical experts" will compare Muttra and Agra with Lucknow as regards fever prevalence, whether malarial or enteric.

In closing, I would repeat this warning, that until the authorities realise the absolute necessity of keeping the water in the wells in cantonments, encampments, railway-stations, and rest-camps pure and free from risks of pollution, enteric fever will continue to increase, though where, from there being a good and safe fall for the surface-drainage, as in Meerut, in the masonry-built drains to the large drains at a distance from the cantonment, the soil is not so easily polluted, enteric fever will be rare in comparison with the most fatal types of continued malarial fever, owing to the altered physical conditions of the country round the cantonment, from the inundating action of the present system of canal irrigation; though, for myself, I have little doubt that in a European constitution the special conditions induced by the gravest forms of malarial fever are such, as to render the system peculiarly favourable to enteric infection, especially when complicated with dysentery or considerable biliary derangement, if this enteric fever is at all, even temporarily, endemic.

POSTSCRIPT.

Owing to the abstract of this paper (soon after it was read) appearing in the *British Medical Journal*, which has a large circulation in India, Brigade-Surgeon H. Skey Muir, M.D., A.M.S., in medical charge of the Hill Sanatorium of Chuckrata, has forwarded a communication to this Society (the Epidemiological Society of London), which was read on the 17th December 1890, in which, among other things, he

points out that the water-supply at that station, alluded to in this paper as having been practically neglected up to 1883, and which I describe as the sole recommendation to an otherwise objectionable site, has, as I suggested many years ago, been lately (1887) brought into the Sanatorium in the manner I then proposed, and the old, and *now* fully admitted dangerously defective, water-supply on the south of the station closed.

I am only too glad to have this early opportunity of making this fact public, though in doing so it does not, in my opinion, as one who knows the whole circumstances of the case, in the least detract from the grave responsibility incurred by the Sanitary Department with the Government of India; and every preventable death which has occurred at Chuckrata, owing to this defective water-supply, since European troops were located there, lies at the door of that Department, and must rest there, as it has failed to bring that pressure to bear on the military authorities which alone can exonerate it from the charge of grossly neglecting the main object of its formation, viz., the prevention of disease; for what was capable of being done in 1887 was equally so in 1869, as I know. For any department, military or medical, to plead the cost of this scheme as an excuse for delaying it, when 40,000 rupees were paid annually for the mule carriage of the water at Chuckrata, and tens of thousands of rupees were spent with a prodigality unheard of in any other hill sanatorium, or station in the plains of India, is, in the case in question, as weak as it is culpable.

Dr. Skey Muir has, in my judgment, failed to show that Chuckrata possesses any advantage over other hill sanatoria on the first, while Chuckrata is on the second range, as he admits the fact that the troops have to go to the plains in the winter, though he does not give the cause, viz., the inability, from the scarcity of firewood, to keep up the heat in the barracks at a temperature suited for troops living at a height above sea-level which registers such a daily range of the thermometer. Further, as it is only this bracing air that could restore the physical and mental tone to an immature constitution undermined, it may be shattered, by malarial fever and residence in the plains, for these troops to be compelled to desert this health-resort, at the most bracing period of the year, for a cause which will increase instead of decrease, and to spend the Indian winter months in the Western Dehra Dhoon, at the foot of the hills, a district far from exempt from some of the worst types of malarial fever, is a very serious blot in the site of this sanatorium, and one

which in my opinion should be fatal to its extension on the Kylana Hill.

The allusions made by Dr. Skey Muir in his remarks on the results of the impure water in the roadside, encampment, and railway-station wells, particularly the latter at Saharanpur, in their bearing on the present alarming increase of enteric fever, are so fully entered into in this paper, and their remedies pointed out, unknown to Dr. Skey Muir however, from the brief extracts of my paper which he saw in the *British Medical Journal*, that I feel it is unnecessary to enter into them further than to say we are both in complete accord with the conviction, that it is to the enteric infection, admitted into the system by means of the impure water in these wells, that enteric fever, in many instances, gains admission (apparently in an unknown manner) and then a footing in stations which, though they might not originate it, are yet, owing to defective sanitation as regards the water supply, likely to continue and spread it.

ROBT. PRINGLE, M.D.

BLACKHEATH, S.E.,
December 19th, 1890.

ON AN EPIDEMIC OF DENGUE FEVER IN FIJI IN 1885.

By A. J. F. SKOTTOWE, M.B.

(*Read: June 11th,* 1890.)

In May of the year 1885 a contagious disease, hitherto unknown in Fiji, made its appearance among the European population of the colony, continued active for some ten months, and then disappeared.

Having once obtained a footing, so to speak, it attacked eventually all the white settlers, men, women, and children, and spread, though somewhat slowly, to the coloured races in the islands, viz., Fijians, Indians, and Melanesians.

The two latter races are introduced, under Government supervision, for the purpose of working on the sugar, tea, coffee, and other plantations of the colony, and it is a curious fact that, while those Fijians and Indians who took the disease suffered severely, those attacked among the Melanesians were affected but slightly.

To the statement that dengue was hitherto unknown in Fiji, I ought, perhaps, to add so far as can be ascertained, for the opinion rests solely on the absence of any native traditions concerning it. Those who know these people, who have lived among them, speaking their language, and who, from their long acquaintance with their legends, manners, and customs, have a right to speak, find it difficult to believe that if dengue had ever before existed in these islands no memory of it should remain, and it is significant that there is no native name for the disease. The old settlers and pioneers also declare that, at any rate during their residence in the country, no disease was known in the least resembling that which appeared in 1885.

On these grounds it is the generally accepted view that the epidemic of that year was the first appearance of dengue in these islands of the Western Pacific.

Dengue, dandy, or break-bone fever, is a disease which has been known epidemically in many parts of the world—in India, the West Indies, "the Southern States of America, the ports of the Gulf of Mexico, the towns of New Orleans,

Savannah, Charlestown, Philadelphia, and New York."—*Aitken.*

It has been known in Spain, where it was called *la piadosa.* It is said to have occurred in the Eastern Pacific, among the natives of the Friendly Islands, and in Tahiti. In 1870 it appeared in Zanzibar, and spread to the East Coast of Africa and to Aden; "and obtained a very wide distribution in Hindostan, especially in Burmah, Bengal, Madras, and Bombay Presidencies, and in some stations hardly an individual escaped."—*Aitken.*

The Zanzibar epidemic has been described by Dr. Christie, in a paper published in the *Glasgow Medical Journal* for September 1881, where he states that it originated "de novo", and points out that this epidemic was not introduced into the island from without. "I have", he says, "exhausted every possible means of investigation without having been able to discover a single case of dengue on the mainland of Africa, or in any of the northern ports which had commercial intercourse with Zanzibar prior to 1870. The disease appeared at the height of the south-west monsoon, and at least three months before dhow communication from the north was possible."

To the list of places where dengue has been found, New Caledonia and Fiji must now be added.

The discovery of the origin of epidemic disease is not always an easy matter, yet there is little room for doubt that the Fijian epidemic of 1885 did not originate "de novo", nor was it the result of the bursting into activity of latent germs from a previous epidemic, if that ever existed, but that it was introduced into Fiji by a person suffering from and exposed to it while at Noumea, the French settlement of New Caledonia, where some time previously the affection had appeared, also, it is said, for the first time.

To this group it had been conveyed by affected passengers from Réunion, where, as well as in Mauritius, there have been several epidemics. Originating in India, the disease has doubtless been carried along the ocean highways to the warm southern islands. Noumea, in addition to being visited by vessels from Réunion, is a port of call for the Australian steamers trading between Sydney and Fiji, and in January and February 1885 these latter vessels, according to Dr. Corney (then health officer for the port of Suva), brought bills of health endorsed thus, "A l'exception d'un très petit nombre de cas de dengue, l'epidémie est sur son declin." In March he adds, "The bills of health were clean, and collateral information indicated that the epidemic in

New Caledonia was at an end. This belief, however, appears to have been of too sanguine a nature, for it was not until the month of May, in the same year, that cases of dengue began to appear in Fiji."

The distance from Noumea to Fiji is three days by steam, and there is fortnightly communication, yet it was not for some considerable time after the apparent cessation of the epidemic in Noumea, and after the consequent suspension of quarantine in Fiji, that the disease was introduced into the last-named colony by the arrival of an infected person; the explanation of this probably being that after the port of Noumea had been declared free from disease cases were still occurring, but of so slight a nature as not to require medical treatment, or to necessitate suspension from work—another example of the fact that the mild cases of infectious disease are the dangerous ones for a community.

In 1874 Fiji witnessed an epidemic of measles. Commencing in the old capital, Levuka, it spread rapidly in all directions throughout the group, attacking the natives even in the outlying islands and those in the fastness of the hills. The number of sick may be judged from the fact that at the close of the epidemic there was an estimated death-rate of 40,000. Some years later whooping-cough broke out, and spread with great rapidity, causing among old people and children a tremendous increase in the mortality.

A few weeks before, and continuing some little time after the dengue outbreak, influenza, "the most typical of all epidemic diseases", had made its appearance. It came mysteriously, travelled in a westerly direction, and, as was to be expected of such an affection, swept through the country to the uttermost corners of the islands.

How different in its progress from these diseases was dengue, resembling rather in its contagiousness relapsing fever, with regard to which it has been shown: (1) that "the disease spreads mainly by being carried by tramps and vagrants" (*Bristowe*); (2) that its prevalence "in single houses or in limited districts is in direct proportion to the degree of intercourse between the healthy and the sick" (*Murchison*); (3) that "persons living in localities where the disease is unknown are attacked on visiting infected persons at a distance" (*Murchison*). Judging from a single epidemic, it would appear that these aphorisms hold good of dengue.

There was the clear evidence that in two colonies in the Western Pacific, where the disease had never before been heard of, its introduction was traced to the arrival of persons

suffering from it. From Réunion it was directly carried to New Caledonia, and from New Caledonia it was carried to Fiji.

In Fiji, the disease, introduced into one of the two European towns, spread to the other through the agency of infected persons. These towns are on separate islands, and are distant from one another sixty miles by sea, but communication is frequent and easy. There were thus early in the epidemic two areas of disease, the intervening country being unaffected. From these foci the fever spread, and it was found that the natives first attacked were those living in towns, chiefly on the coast, near the two European settlements.

Owing to the rough nature of the country, it was thus these natives, from their proximity to the "white man's" town, and from the ease with which they could bring their vegetable products, etc., in canoes, for sale in the public markets, or vend them round from house to house, who were first exposed to infection. The affection then spread among the natives to other districts, involving gradually large tracts of land, and attacking whole villages. From Suva, on the one island, it crept westward among the natives along the southern coast of Viti Levu, and appeared among the native towns and among the labour on the plantations on the banks of the Navua River, and it spread eastward to the towns and plantations on the banks of the Rewa River; from thence it spread inland, and along the east coast.

From Levuka, on the other island, it was carried to the native towns north and south along the coast; later on it appeared in the western and northern islands lying at no great distance off, and in frequent communication by boats, and it passed along the northern coast of the large island as far as Ba, but, according to Dr. Corney, it was not till Christmas that the epidemic appeared here, in Lomaloma, and in the Lan islands. Ba is about 120 miles from Levuka, so that nearly seven months elapsed between the commencement of the epidemic and its appearance in the north-west extremity of Viti Levu.

The natives living in outlying islands both to the east and west, and those in the interior of the larger ones, escaped altogether, the only explanation of their exemption from the disease being that they were not in communication with affected districts.

The routes just described along which the disease travelled were the common highways of communication between the European towns and the surrounding districts. It thus

appeared that the spread of dengue followed the lines of traffic, and, as evidenced by its behaviour in New Caledonia and Fiji, that human intercourse was the means of its propagation.

This method of progress was quite in accordance with that observed in other epidemics. "With regard to the diffusion of the epidemic from Zanzibar to the mainland," writes Dr. Christie, "I can only state generally that it took place along the lines of human intercourse, and that the coast towns were affected." He was under the impression, however, that it did not prevail to any great extent inland, as he heard nothing of it. In reference to the introduction of the disease into the West Indies, the same authority is of the opinion that it was imported direct from the East Coast of Africa; and Dr. Stedman, the earliest historian of the epidemic in St. Thomas, says, "The contagion was supposed to have been brought by a vessel from the coast of Africa which touched at St. Thomas."

Dengue, then, once introduced into a town or district, spreads in the manner related, and this very method of spreading seemed to indicate that the poison did not travel far through the atmosphere. As I have already pointed out, the port of Noumea was still infected after it had been declared free from disease, and during the interval between the granting of clean bills of health there and the appearance of dengue in Fiji, several steamers from the colonies touched at Noumea, remaining in port on an average of twenty-four hours, and bringing both passengers and merchandise for Suva, yet it was not until a person actually suffering from dengue landed in Fiji that the disease became rife among us. Again, as may be remembered, there were, in the early part of the epidemic in Fiji, two centres of disease, yet the intervening area of country was for a long time unaffected.

These facts tend, I think, to support the theory that the poison of dengue is destroyed, or, at any rate, greatly diminished in virulence by atmospheric dilution.

The Fijian epidemic of dengue was a very interesting one, because it is believed to have been the first appearance of the disease in those islands of the Western Pacific. It broke out during the prevalence of an epidemic of influenza, and in many of its symptoms it differed considerably from that described by various writers in the text-books and periodicals of medicine.

The latent period of dengue is for many reasons very difficult to fix, but authorities have stated it to be from a few hours to one week, and the two following examples

indicate that it may be very short in point of time. Dr. Corney tells us that his second attack of dengue followed shortly after new exposure to infection, but I give the description in his own words. "A friend and colleague, who could clearly trace the origin of his infection, was sleeping in a native house near my own quarters when taken ill, and, in order to place him under more favourable conditions for a speedy recovery, I rashly changed beds with him, and slept in his mosquito screen. On this occasion I underwent a typical course of dengue." The other example is from my own experience. While suffering from dengue I had occasion to travel to Suva. The fatigue of a ten hours' journey by boat utterly prostrated me, and, on getting to my hotel, I was obliged to lay down on the bed in the first room I came to, simply intending to rest a little, and then go to my own room; but, falling asleep, a friend, to whom the room belonged, would not disturb me, and I remained there all night. Next morning I moved to my own room, and that night my friend slept in his own bed, and in forty-eight hours was down with dengue. Up to the time of sleeping in the infected bed he had been perfectly well, and had not, so far as he knew, been exposed to the poison.

Symptoms.—After an incubation period, then, of varying duration, an attack of dengue commenced suddenly, with rigours alternating with flushes of heat, elevation of temperature, general feeling of uneasiness, and pains in the limbs, back, and head. The temperature then rose rapidly, and the pain increased, especially in the joints, limbs, and head. The face was flushed, and there was swelling of the eyelids and injection of the conjunctivæ, accompanied with aching of the eyeballs and intolerance of light.

By the evening of the second day, though sometimes on the evening of the first, the temperature reached its acme, 104° or 106° being frequently recorded. There were rapid pulse, loss of appetite, and sometimes troublesome gastric irritation, dry tongue, hot dry skin, great restlessness, especially at night, scanty urine, and other symptoms of fever. Later on the tongue became coated with a whitish fur, a very characteristic feature of the disease.

In none of the cases under my care did albumen appear in the urine, but a few of the urines examined by Dr. Corney were found to be slightly albuminous.

The symptoms increased in severity, and on the third day the prostration was very great; the skin, dry before, about this time became moist, and the so-called initial rash made its appearance, but passed off usually by the second day.

The temperature now fell, but remained febrile; the symptoms abated somewhat, pain was reduced, and a general improvement took place. Prostration, however, was unrelieved, and formed a very striking feature of the attack, and there was still more or less sleeplessness. After a day or two of this improvement the temperature again rose, and there was an exacerbation of all the symptoms, lasting two or three days, and accompanied by a second eruption, the disappearance of which, like the first, was followed by desquamation. From the eighth to the tenth day the fever terminated, there was rapid fall of temperature, accompanied by profuse perspiration, and great relief from all the distressing symptoms except the prostration, which was then very marked. Muscular debility, indeed, was apt to last long, and make convalescence tedious.

This account applies to the progress of a typical case, but there were, of course, a large number which were far from characteristic. Some were of such short duration and so mild in form as not to necessitate confinement in bed, and to render diagnosis doubtful. In some the slight attacks lasted only two or three days, the pain in the limbs was not severe, the so-called eruptions (initial and terminal) were entirely absent, fever was slight, but, if careful thermometric observations were made, it was still found to be remittent in type; yet, no matter how slight the attack, prostration was more or less marked. The majority of cases, indeed, were not what might be called typical in the ordinary acceptation of the term—that is to say, the greatest number did not individually present all the more noticeable symptoms in combination; and, such being the case, it might be well to discuss the various phenomena of the disease *seriatim*, in which endeavour I have to acknowledge the aid rendered me by those of my colleagues on the medical staff in Fiji, who have given me the result of their experience and their opinions.

Almost without exception the disease commenced suddenly with rigours or chilliness, fever, and pain. The pain was of a shooting, shifting character, and was complained of in the head, eyeballs, limbs, and joints; in the latter situations it was rheumatic in nature, but was rarely accompanied by effusion. Indeed, during the whole epidemic I did not see a single case with joint complications; but Dr. Corney writes that, "among Indian immigrants, some cases of synovitis were spoken of at the time, which may, or may not, have been an accompaniment or sequela of dengue."

"Generalised muscular pains", writes Dr. Blyth, "especi-

ally in the calves and loins, and extreme aching in the fibrinous tissues and tendinous insertions of the eyeballs, were never absent. In only one case were joint complications met with, viz., in a European boy, aged eight years, in whose ankle-joints effusions appeared on the second day of the fever. The exudation was very moderate in quantity, and had quite disappeared when convalescence set in. This was the only instance met with in which large joints were involved; the small articulations, such as those of the fingers, were in no case implicated." In a conversation I had lately with Dr. Blyth on this subject, he mentioned that, six months after a patient of his was convalescent from dengue, synovitis of both knee joints developed.

This interval of six months seems, at first sight, to be a long time between convalescence from a disease and the appearance of a complication or sequela; but paralysis has been known to follow recovery from diphtheria after a still longer interval, and the tertiary symptoms of syphilis have followed many years after the primary manifestation. The two cases just instanced, and the doubtful ones referred to among Indian immigrants, were all that were known of joint complications during this epidemic.

The appetite during the progress of severe cases was very poor, and it was found to be very difficult to get patients to take nourishment; there seemed, indeed, to be a loathing of food. Complicating this there was, in some few cases, a certain amount of gastric irritation, chiefly showing itself in the form of pain over a limited area of the epigastrium. Among many there was a wretched feeling of nausea, without any attempt at vomiting, the patients stating if they could but vomit they felt as if relief would follow. In my own instance this feeling of nausea was most distressing, and lasted nearly two days, though I had by no means a sharp attack of dengue.

Actual vomiting was very rare, though, in a few cases, there was slight retching. All through the epidemic there was nothing approaching in severity the nausea and vomiting described as common in relapsing fever, and no case of hæmatemesis was recorded. In many there was no stomach trouble; food was fairly well taken, and even relished.

Thermometric observations in this epidemic showed that the fever was distinctly remittent in type. In really typical cases the temperature throughout was very characteristic; rising rapidly, it reached, sometimes on the first evening of the attack, but more usually on the second day, 104° or 106°, remained at this elevation for a day or so, and then fell, but

continued distinctly febrile, and kept so for two or three days, when it again rose to, or almost to, its former height. It then, in a day or two, fell quickly, the fever terminating about the eighth day. Dr. Corney writes: "The fever usually remitted on the third day, but in many cases the remission was not well marked, or was very gradual, and the temperature rose again suddenly after reaching its minimum. Its mean duration was about two days, but it was very irregular. Some cases remitted twice, the three exacerbations and the two intervening remissions lasting each two days. In my own instance", he continues, "this occurred, crisis by sweating following on the eleventh day."

"The temperature in the cases of dengue I met with", says Dr. Blyth, "was of a typically remittent kind, and this without exception. The initial rise was sharp and sudden, and in every case the temperature fell to nearly normal on the third day for a few hours, again suddenly attaining its previous height, and terminating in a crisis on the seventh day of the illness on an average. During the remission the patient experienced comparative freedom from all the symptoms, but invariably an exacerbation of all these occurred simultaneously with the secondary rise of temperature."

The experience, therefore, of this Fijian epidemic showed that during the remission of the fever the temperature remained distinctly febrile. This state of matters was not, however, observed by Dr. Christie in the Zanzibar epidemic, for, after referring to the initial symptoms, he says: "Then followed a period of remission of from two to three days, during which the febrile symptoms were completely absent, there being only general debility and slight muscular pains"; and Dr. J. G. Thomas, of Savannah, quoted by Dr. Christie, after noting the quick rise of temperature, writes: "The fastigium is generally very short, and the defervescence is rapid, and characterised by a succession of remissions and exacerbations, the temperature of each remission reaching lower than, and that of each exacerbation not so high as, that of the preceding, until it has fallen one to one and a-half degrees lower than the natural heat of the body." It was then found that the temperature fluctuated "from a degree below to one or two degrees above the normal heat", and was followed by a secondary fever, which, "as a rule," he adds, "soon subsides, and the temperature remains normal, unless there is a relapse." It is thus interesting to note that, in Dr. Thomas' experience, the temperature during the remission was subject to considerable variations, fluctuating between the apyrexial and the febrile state.

That the Fijian fever was not malarial, nor modified by malaria, is evidenced by the almost entire absence of miasmatic disease in the country. During the whole of my residence in Fiji, where many hundred cases of sickness came under my observation, I only saw two of true remittent fever, and a few of ague; the former in natives from certain of the Western Pacific islands, where malaria is endemic, and the latter in Indians, who had contracted the affection before in their own country.

Owing to the prevalence of an epidemic of influenza, before and continuing some little time after the outbreak of dengue, considerable difficulty existed in at first differentiating the diseases. After a time it was observed, however, that many cases presented a peculiar eruption of the skin, and later experience showed that this appeared in certain of the class of cases where the thermometer indicated a remittent type of fever. The rash, therefore, became a diagnostic aid. In the early weeks of the dengue epidemic, many cases, with ill-defined symptoms, were certainly not recognised, and it was not until some undoubtedly typical cases were seen, with all the more notable signs well developed, that it became evident dengue was superadded to influenza.

Now, among the early phenomena of the disease are flushing of the face and puffiness, especially of the eyelids, to which, on or about the third day, in some cases, there might, however, be superadded an erythematous, roseolous, or lichenous rash on neck, shoulders, and chest, or other parts of the body and limbs. About the feet, ankles, and palms of the hands, writes Dr. Corney, "it would be patchy and well marked; its character was fugitive, and a few hours or a day would suffice for its disappearance"; but, he continues, "in most of the cases where a rash appeared it was a terminal one".

Dr. Blyth writes: "I never saw a case with both an initial and a terminal rash—that is, an initial entirely disappearing, and followed by a secondary or terminal one"; and Dr. Pound states that he never saw a case with a rash at the commencement and another at the termination. In Dr. Christie's paper there is no mention of an initial rash.* In describing the disease, he says that in the first stage "the face is of a bright scarlet colour, which disappeared on pressure, and returned when the pressure was removed. The scarlet flush was in every case peculiarly marked, extending

* In this paper there is no mention of either initial or terminal rashes; but he describes an exanthematous eruption appearing on the fifth day, which is called "the eruption".

from cheek-bone to cheek-bone across the bridge of the nose, and was accompanied with a puffy swelling. This appearance was almost identical with the usual symptoms of an attack of erysipelas of the face, and was so well marked that I always regarded it as diagnostic of the first stage of the disease." This flushing of the face, accompanied by swelling, was observed by all who had to deal with the disease in Fiji, but it never took on the erysipelatous character just described.

My own experience in the Fijian epidemic was that only in a very few cases were patches of redness found on chest, shoulders, feet, palms of hands, etc., but that in almost every case the flushing of the face and swelling of eyelids were prominent features of the affection. This flushing, indeed, seemed to me to be of the nature of a simple erythema: it disappeared on pressure, and returned when the pressure was removed; it was attended with swelling, more or less; it possessed a fairly well-defined margin, and it terminated in desquamation; and I was further of the opinion that in those few cases where, on the third day, evanescent patches of redness appeared on chest, shoulders, feet, palms of hands, etc., these were to be regarded as fugitive varieties of erythema, patches of redness closely related to those sometimes observed in rheumatism and in certain of the specific fevers. In other words, that the so-called initial rash of dengue, described as appearing on the second or third day, was really simply a variety of the erythema almost invariably seen to be developed on the face as a primary symptom.

According to this view, the initial eruption would be described as erythematous in character, accompanied by swelling, and appearing on the face on the first day of the illness, and that about the third day fugitive patches sometimes appeared on chest, shoulders, palms of the hands, etc., the whole eruption defervescing with the first fall of the temperature.

With the secondary rise of temperature another eruption, erythematous in character, but occasionally complicated by urticaria, made its appearance, and later experience demonstrated that this rash only occurred in about fifty per cent. of those attacked. In many of the cases where this terminal rash, as it is called, appeared, no fugitive patches of redness (the so-called initial rash) had been noticed about the third day. Like the first, it was of short duration, and disappeared with the secondary fall of temperature, while desquamation was the common sequence of both varieties. Dr. Blyth told

me of an interesting case of his, where the erythematous condition of the face, instead of passing off with the first fall of the temperature, as was the rule, lasted from the beginning to the end of the disease.

The severe complications described by various writers on dengue, such as bleeding at the nose, swelling of the parotids with salivation, swelling of the lymphatic glands, jaundice and ophthalmia, were neither seen by Drs. Blyth, Pound, nor myself, and sore-throat, when present, was very trifling; and Dr. Corney only noticed "very generally a swelling and tenderness of the glandular concatenatæ on one or both sides of the neck, without any particular sore-throat. I saw no epistaxis," he says, "but I think I recollect hearing of one or two cases."* In a few instances boils gave some inconvenience, and there were lingering pains about the phalangeal joints. The pain was, however, not of long duration, nor was it accompanied by joint mischief. Chest complications also were quite unknown.

Among my own patients were several pregnant women, two of whose attacks of dengue were typical and severe, yet I never saw abortion result, nor, indeed, any signs of uterine efforts at expulsion of the contents. Convalescence was, on the whole, protracted, though in many cases, and my own instance was an example, recovery was rapid and complete. After typical attacks, however, convalescence was undoubtedly slow; indeed, according to one observer, it was sometimes three months in being established, while, in some cases, "original vigour was never regained".

"Robust men," he adds, "who had never had an illness in their lives, would say they never felt so mean as this petty sickness of only a week's duration left them." The symptom of all others, in fact, which complicated convalescence was muscular debility, and it was, in very many cases, marked and persistent.

Throughout the whole epidemic I neither saw nor heard of a case terminating fatally, but it was stated by the acting chief medical officer that "several natives died from dengue, or from complications arising out of rash behaviour while ill of it. Their number may probably be counted only by tens, while the total native population amounts to 110,000." I would point out, however, that these deaths were reported by the natives themselves, and that the patients were not seen by any of the

* These cases, it may be noted, were not seen by medical men, and were probably cases of influenza, the patients, suffering from pains in back, limbs, etc., themselves designating their disease as dengue.

medical men of the colony. They may, or may not, therefore, have been cases of dengue. Previous experience, gained notably in the measles epidemic of 1874 (and I give it on the authority of one who witnessed that terrible scourge), showed that these people, while suffering from fever, were wont to plunge into, and remain for some considerable time in, the coldest water they could find, and it was with the greatest difficulty they could be restrained from so doing. As might be expected from this wholesale cold water treatment, pneumonia, dysentery, and other inflammatory complications, carried the people off by thousands. If, then, any deaths occurred among the natives from dengue, it was, in all probability, through the supervention of some inflammatory affection, the result of their "rash behaviour".

I would now revert to the statement of Dr. Thomas, to which I have already drawn your attention in discussing the course of the temperature in this disease. After describing the secondary fall, he says: "This heat soon subsides, and the temperature remains normal unless there is a relapse."* The use of the word relapse opens up a question of considerable interest, and one upon which great differences of opinion exist.

Now, the second or third exacerbations, following the remissions so typical of dengue, can hardly be called relapses, seeing that during the remission the temperature is still febrile, and the symptoms, though relieved, are still prominent. In other words, the exacerbation of a case of dengue bears no analogy to the relapse proper of relapsing fever, occurring on the fourteenth day of the illness, following an interval of complete apyrexia and cessation of symptoms.

During the existence of the epidemic in Fiji many people had two, and some even three attacks, the acuteness of which seemed to bear no relationship to the severity of the former seizure, for it was noticed that in many cases where the first illness had been slight, the second was more severe, while in some the second was still more trifling.

In dengue, therefore, it is not the exacerbations of the primary illness, but second or third attacks, occurring after periods of convalescence, which, at first sight, seem to bear some likeness to relapses; but they occurred in different individuals after periods of convalescence varying greatly in

* "The disease seems to combine an exanthematous eruption, ushered in by fever, with a rheumatic or neuralgic state, and the cause of the malady is so divided by intervals and remissions as to give one the idea that relapses are of frequent occurrence in its course."—*Aitken.*

time. They were traced, in the majority of cases, to be the result of new exposure to infection. An example of this I have already given, where a second attack resulted after sleeping in an infected bed, and when these new attacks developed they had all the characters, more or less marked, of the first illness, viz., a sudden rise in temperature, followed by a fall, and a secondary rise, with the other symptoms as already described.

It would thus seem that second and third attacks were not relapses in the true sense of the term, but that they were really new attacks, due to fresh exposure to the specific poison. From this it follows that one attack of dengue does not in any way afford protection from subsequent ones. "I never saw a case of true relapse," writes Dr. Blyth; and Dr. Corney says, "From my own practice during the epidemic I formed the opinion that the so-called relapses were in reality new attacks. Of course, this involved a belief that a first attack confers no protection against a recurrence of the disease if a new exposure to infection be incurred."

I would now like to point out some of the differences between dengue, as seen in Fiji, and two other diseases, each of which has, by various writers, been suggested as being related to it. One of these, influenza, was existent epidemically at the same time as dengue, so that abundant opportunities were afforded of studying the two diseases together. Indeed, one instance was recorded by Dr. Blyth where, in the same house and at the same time, one member of the family was suffering from influenza, another from dengue.

At the very outset of this investigation there is found to be a marked difference between the contagiousness of these two diseases. With regard to influenza, Professor Gairdner has pointed out, "It is notorious, and well ascertained from the experience of centuries", that the disease "occurs and spreads almost indifferently in all climates, in almost all latitudes and longitudes, in all seasons, amid all prevailing winds or no winds, amid a variety of atmospheric conditions, in short, which make it almost impossible to suppose that these alone contain the secret of its prevalence. Under these varied and varying conditions it makes its way steadily over a wide area, so as to subdue whole populations to its influence, and even to affect very seriously the death-rate of localities through the enormous numbers attacked." The Fijian epidemic came apparently from the east, passed quickly from one part of the country to another, following no beaten track, and involved entire islands within very brief

limits of time. Dengue, on the other hand, came from the west, and spread slowly along the lines of human intercourse; its prevalence in any locality was in direct proportion to the degree of intercourse between the healthy and the sick, and those parts of the country not in communication with infected districts escaped altogether.

The two diseases resembled one another, however, in the suddenness of their origin, with rigours and fever, pain in the head and limbs, sleeplessness, and prostration. These were common factors in both, but catarrhal symptoms in the majority of cases early made their appearance in influenza. (It is, indeed, a contagious catarrhal affection of the respiratory tract.) The naso-laryngo-bronchial mucous membrane discharged, and cough was troublesome, and, though in a few cases these symptoms were not marked, they were entirely wanting in dengue. The prostration of influenza, according to Dr. Parkes, bears "a close ratio to the extent of the pulmonary affection, and consequently to the severity of the disease." That of dengue must have another explanation, seeing that in this affection there was no tendency to pulmonary mischief; the prostration appeared early, increased with the progress of the disease, and was marked even in the mildest attack.

The temperature* of dengue was distinctly remittent, not so that of influenza; but if in this a secondary rise did take place, or if the temperature, instead of falling, remained high, like the tertiary fever of small-pox, it was the result of inflammatory mischief (1). The temperature fell suddenly in dengue, gradually in influenza (2). The face was sometimes flushed in influenza, but this was not marked in all cases, nor did it ever form the prominent symptom that it

* Surgeon F. Wyville Thompson, M.B., writes in the *British Medical Journal*, May 31, 1890, on an epidemic of influenza in an Indian regiment, and the disease, as described by him, was much the same as we saw it in Fiji. The course of the temperature, however, was different, being intermittent in type, which "does not apparently agree with the features of the disease in Europe, and is probably owing to the assumption of a malarial type by the epidemic, as might be expected among the natives of India. (1) Those few cases where the temperature remained constantly above the normal for a few days were complicated by bronchopneumonia". It varied in height according to the severity of the disease, "and (2) then fell gradually to normal".

"The symptoms were pretty regular, the following being the chief: fever, great prostration, vertigo, frontal headache, bronchitis, pain in the limbs and back, loss of appetite, (4) epistaxis, hæmoptysis, and congested throat.

"Bronchitis was always present, with a profuse discharge of sputum, often tinged with blood. (3) There was no coryza or lachrymation, and, although Goorkhas are peculiarly liable to conjunctival inflammation, it was never associated with the influenza."

did in dengue, neither was it accompanied by swelling nor congestion of the conjunctivæ (3).

A few cases of influenza have been described in which a rash appeared. I have seen none such, but from all accounts it seems to have been irregular in character, and in the time of its development. The eruptions of dengue have already been narrated; the terminal one, appearing with the secondary rise of temperature in fifty per cent. of those attacked, being peculiar to the fever.

(4) Epistaxis and other hæmorrhages were not unknown in influenza; they were never met with in dengue. And, lastly, the silvery white tongue of dengue was almost diagnostic, and was quite distinct from the dirty yellow or yellowish brown tongue of influenza.

The other disease to which dengue has been thought to be related is relapsing fever. In their contagiousness these two diseases are much alike; indeed, in their method of progress they seem almost identical, and in other points they are also alike. "It is obvious", says Dr. Bristowe, "that the phenomena of dengue have a considerable resemblance in some aspects to those of rheumatism, ague, scarlet fever, and measles, with each of which it has been confounded. But it much more closely resembles relapsing fever. It resembles this in its virulence of contagion, in its sudden access, high temperature with headache and arthritic pains, in the rareness of the occurrence of delirium, in its tendency to be continued by several successive relapses, in its little mortality, and even in some of the details of symptoms and sequelæ, such as the condition of tongue and appetite, the occasional occurrence of jaundice, ophthalmia, and inflammation of the salivary and other glands, and even in the supervention of death from syncope during the period of defervescence. The eruption of dengue (if it be specific) may seem to indicate a difference between them, as also may the intensity of the arthritic inflammations which attend it. Can it be relapsing fever modified by climate?"

The account of the temperature course described by Dr. Christie, where, after the first fall, there is a period of apyrexia, followed, after a definite period, by a secondary rise, is certainly another feature of resemblance. But I am comparing the two diseases from the observation of the Fijian epidemic of dengue, in which, as I have stated, the temperature between the first and second rises did not reach the normal, but remained febrile, and this without exception; in other words, the fever was not relapsing. But there are many other points of contrast between the two, such differ-

ences, indeed, as make it difficult to believe that they are at all related.

The following symptoms are among those which Murchison tabulates as diagnostic of relapsing fever :—

(1) "The frequency of jaundice, of vomiting, and of tenderness and enlargement of the liver and spleen."

(2) "The presence of epistaxis and other hæmorrhages, as from the uterus, bowels, or ears."

(3) "The invariable occurrence of abortions in pregnant females."

(4) "The absence of a rash."

(5) "The occurrence of ophthalmia as a sequela."

(6) "The 'ferrety' eye, or the injected conjunctivæ is comparatively rare."

The injected conjunctivæ was observed in all the dengue cases, and vomiting was very rare. Dengue possesses typical eruptions, which have already been referred to. All the other symptoms just enumerated were entirely unknown throughout the dengue epidemic, and, as I have already said, pregnant women did not abort.

Sleeplessness was common to both diseases, as also the occurrence of perspiration at the crisis (both phenomena are, however, common to many other affections), but the delirium or the supervention of the typhoid state, sometimes seen at this time in relapsing fever, was never observed in dengue, nor were the critical perspirations of the latter ever replaced by hæmorrhagic discharges, as sometimes they were in the former.

Sudden syncope occurs occasionally in relapsing fever, and has been known to appear in the primary paroxysm, in the intermission, or in the relapse. "The most extraordinary circumstance is", says Murchison, "that these symptoms may come on suddenly in cases previously mild, and may terminate in death within a few hours after the patient has been looked upon as in no danger."

Syncope was not observed in a single case of dengue from the beginning to the end of the epidemic, and no authentic case was recorded as having a fatal termination.

Lastly, so far as I am aware, nothing resembling spirilla, nor, indeed, has any abnormality, been detected in the blood of dengue patients.

It would thus appear, if opinions may be formulated from the experience of one epidemic, that dengue is a specifically distinct fever. It is contagious beyond all question, and, in the light of modern pathology, it is probable that its contagiousness depends upon a specific poison.

"The progress of pathological science", writes Dr. Bristowe, "leaves little room for doubt that all truly epidemic diseases are communicable directly or indirectly from the sick to the healthy, and that their spread is due solely to the operation of a specific virus, which the former yield and the latter absorb."

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